

FRANK H. GREHL

# IBM ELECTRIC TYPEWRITERS

CUSTOMER ENGINEERING MANUAL OF INSTRUCTION

STANDARD

EXECUTIVE

ELECTRIC FORMSWRITER

ELECTRIC DECIMAL TABULATION

INTERNATIONAL BUSINESS MACHINES CORPORATION

NEW YORK 22, NEW YORK



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STANDARD  
EXECUTIVE  
ELECTRIC FORMSWRITER  
ELECTRIC DECIMAL TABULATION

Issued to J. E. H. Guehl  
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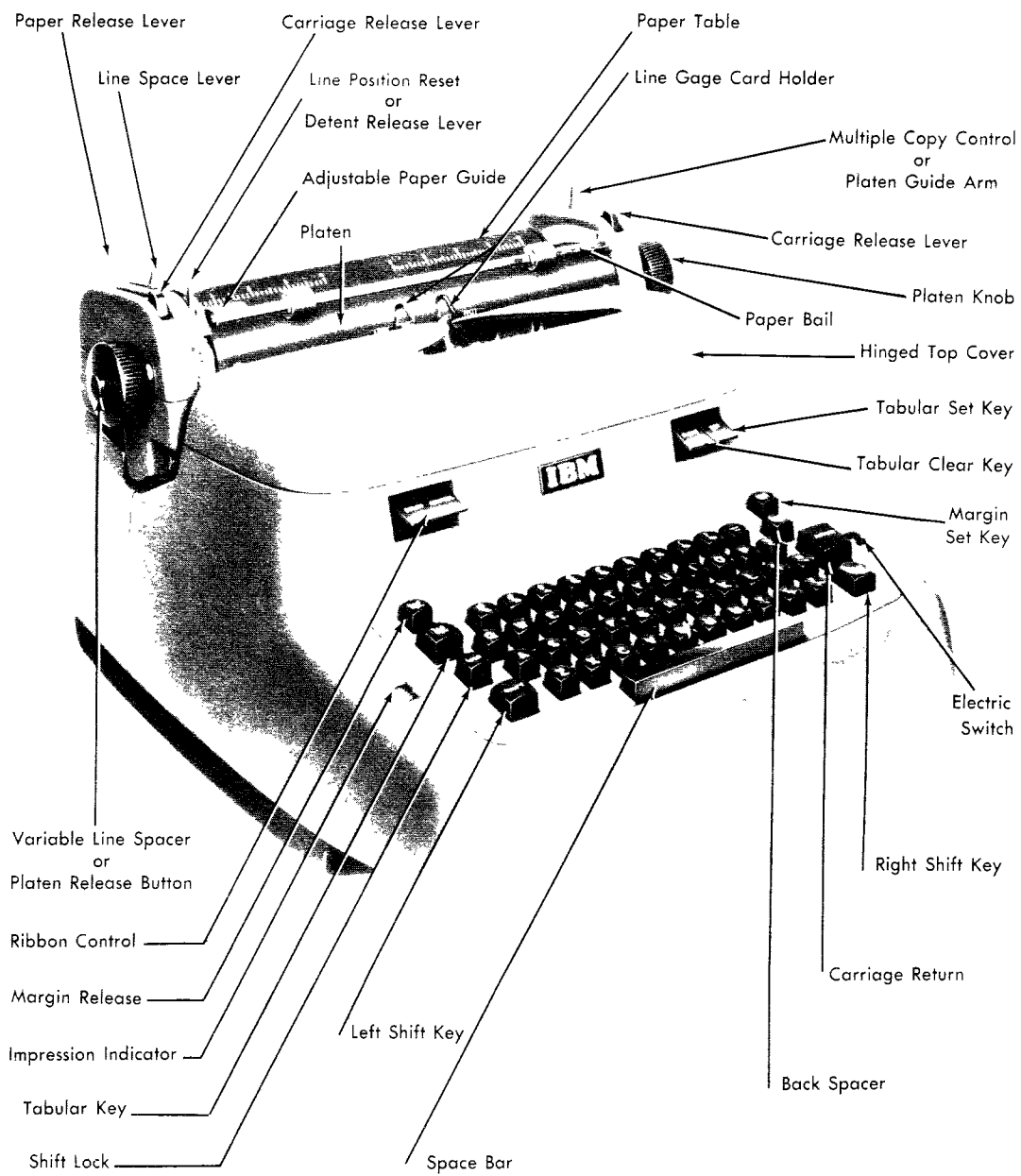
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Electric Standard Typewriter

## IBM ELECTRIC TYPEWRITERS

In this manual, material has been assembled from many different sources in order to provide basic information regarding all current models of the IBM Electric Typewriter. The general plan of the manual is to discuss the mechanical principles of all features and then to cover the removal and adjustment procedures. If it is desired to locate an individual item, the index in the back of the book lists all features by model, alphabetically.

Information is also included to assist the reader in servicing various applications of the machines. The IBM Electric Typewriter, because of its ease and speed of operation and its uniformity of impression, has become an indispensable unit in the operation of the modern business and professional office.

Speed of operation results from the saving in operator energy. The machine requires only a 2-1/2 to 3-ounce touch on the keys to release any of the type or functional operations. The IBM Electric Typewriter is 16 times easier to operate than a hand-powered typewriter, based on key strokes alone. Carriage return operations are performed with 1/500 of the manual effort. Considering these figures, it is not surprising that the operator has chosen the IBM Electric in every instance where speed, smoothness and uniformity are required and appreciated.

### GENERAL INFORMATION

All pertinent Customer Engineering Instruction Memoranda issued by the Electric Typewriter Division from the time the Standard Typewriter was introduced, 138 through 270, have been incorporated into the text of this manual. Part numbers have not been included here since they are properly cataloged in the Parts Price List. Notice of any subsequent developments will be published in the regular form of C.E.I. Memoranda.

#### Definitions

The front of the machine is considered to be the keyboard side.

Right and left sides are designated from the operator's position facing the machine.

Positions of the type bars, key levers and cam lever assemblies are designated 1 through 42 from left to right on the standard, 84-character machine. Extra positions, when required, are designated 00 and 0 on the left and 43 and 44 on the right.

The first row of keys is the highest row, the fourth row being nearest to the operator.

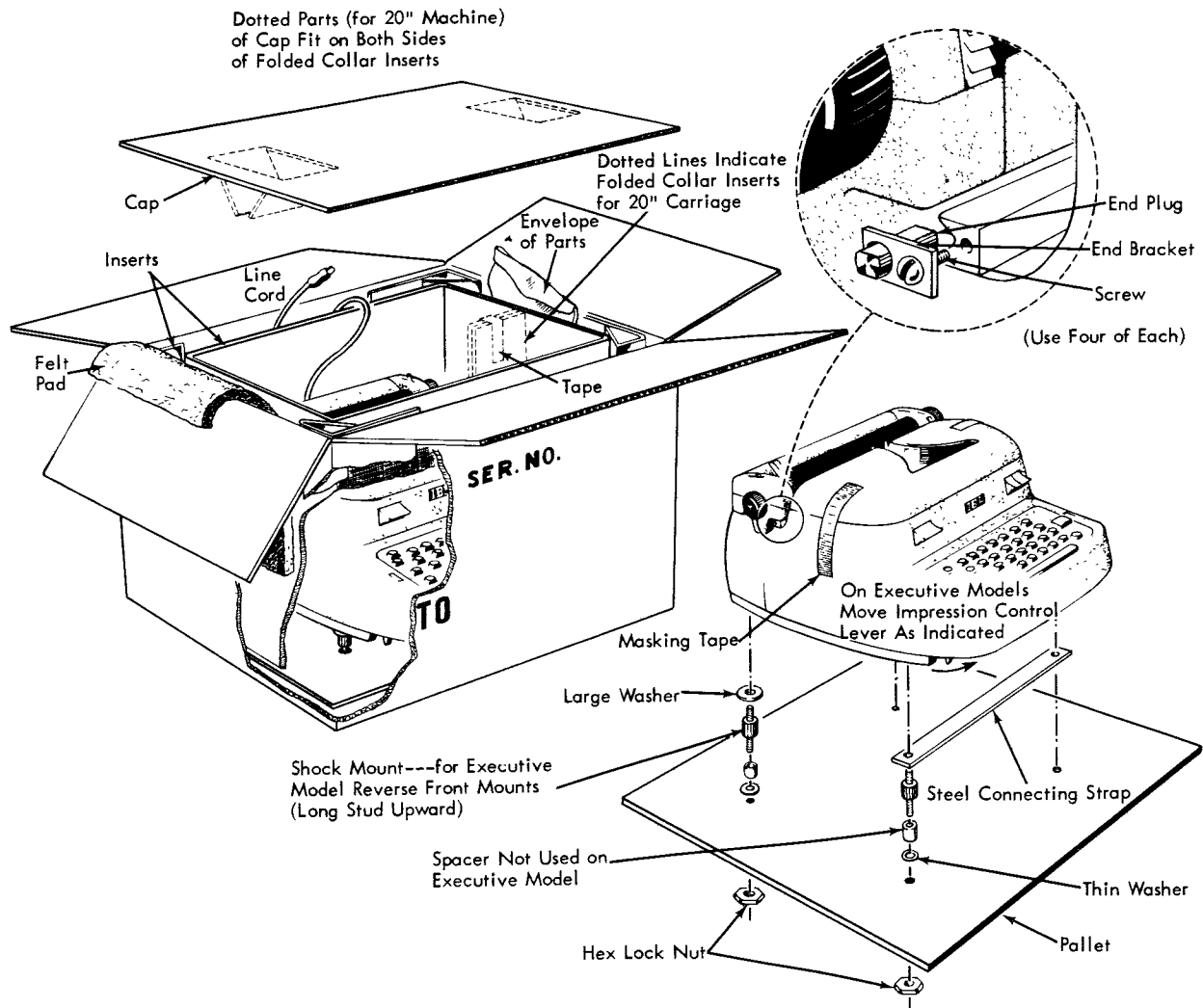


Figure 1. Proper Packaging

### Packaging

The packaging of machines has received a great deal of careful consideration so that the many different adjustments will be maintained through all conditions of shipment. It is well for Customer Engineers in the field to become familiar with the packaging procedure outlined here.

Carriage end plugs must be inserted, and the end brackets which hold them in place must be fastened securely (Figure 1).

Rubber inserts to prevent type basket movement must be inserted in place.

The top cover must be held in place with masking tape.

Typewriter feet must be replaced with the rubber shock mounts and fastened securely to the pallet with large hex nuts. The steel connecting strap must be placed across the front feet locations. Include all washers and spacers in proper location as shown on the drawing.

Typewriter feet and mounting parts must be packaged and placed between the collar insert and the side of the carton to avoid contact with the machine. The line cord plug should also be kept from contact with the machine in this manner.

The corner inserts must be in place.

Twenty-inch carriage length machines must have the special "C" shaped collars fastened together with masking tape. These provide added support to prevent shifting of the machine.

Paper bail must be tied down.

The rear mounting is identical for both the Standard and Executive Models. The front mounting is changed on the Executive to provide clearance for the selector bars. The shock mount is reversed so that the long stud is fastened to the machine. Two of the large washers are used between the machine and the connecting strap on each front foot position. The front spacer is not used on the Executive Model.

A front bottom cover is provided for the Electric Executive Typewriter, which is designed to protect the selector bars and the associated links. It is held in place by the front feet of the machine and by a screw in the frame (Figure 2).

This cover will not be attached to the machine at the factory but will be located in the packing carton between the liner and the front side of the carton. A slit is provided in the liner for the insertion of the offset in the cover.

When repacking machines for shipment in the field, this cover should be removed from the machine and located in the packing carton as described.

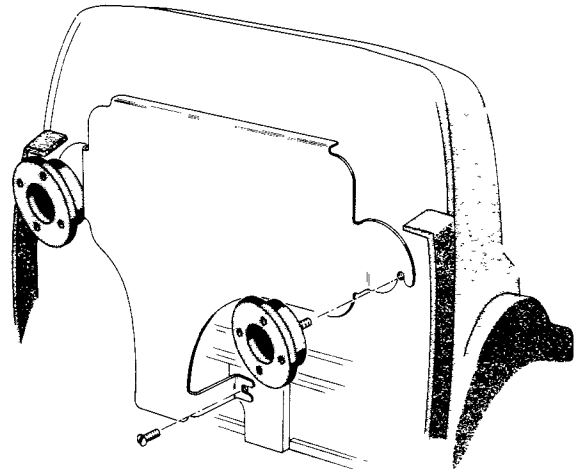


Figure 2. Front Bottom Cover

Covers may be installed on Executive Typewriters in the field by locating the cover in position and providing an 8-32 tapped hole in the power frame for the insertion of the screw.

#### Checking

The following is intended as a standard operational test which should require approximately 15 minutes to complete.

#### Note:

1. Condition of Package
2. Machine Appearance
3. Complete Enclosures

#### 1. Base and Cover Plates

Check for fit of cover and mounting ring.

#### 2. Motor and Electrical

Check for proper switch operation and motor response.

### 3. Power Roll and Drive

Check power roll speed, cam clearance and releasing of functional cams. (Do not make any changes unless completed operational test indicates actual need.)

### 4. Carriage Return

Should be positive on short returns with line space lever at 3. The Executive should hold the margin on repeated line spacing at single and double but will just fail on triple. Must not lock during repeated line spacing with line space lever at 1.

### 5. Line Spacing

Check for proper engagement and line spacing.

### 6. Tab Set and Clear Buttons

Should operate without undue strain and without bottoming.

### 7. Tabulation

a. Set stops at 10, 20, 70, 85 and 100 (12" Carriage).

b. The carriage should operate at the same rate of speed as on carriage return.

c. Test as follows :

<u>10</u>	<u>20</u>	<u>70</u>	<u>85</u>	<u>100</u>
x	x	x	x	x
x	x	x	x	x
xx	xx	xx	xx	xx
xxx	xxx	xxx	xxx	xxx
xxxx	xxxx	xxxx	xxxx	xxxx

d. On Executive Models, check grouping and latching of pawls. Because the friction governor plate and its felt ring may tend to

adhere to one another right after a machine is unpacked, it should be standard practice to work it free as a part of the checking procedure. The margin stops should be set as far apart as possible and then, with all tab stops cleared and with the tab lever latched out, the carriage should be run back and forth several times by hand. This action will serve to polish the friction governor plate and will insure a smoother operation.

### 8. Back Spacer

a. Test operation on each end and middle section of the carriage.

b. Press down on the carriage release lever and repeat the test to be sure the pawls do not engage the escapement rack.

c. Back space test on the Executive should be made with a series of i's typed alternately with back space operations (iiiiii) at the left, center, and right of carriage.

### 9. Shift

Test for rapid, easy operation. (Shift motion test to be made later in conjunction with typing test.)

### 10. Space Bar(s)

Test for ease of operation. (Future testing to be made later in conjunction with typing test.)

### 11. Margin Set and Release

Must release margin stops and operate easily.

### 12. Carriage Release

Hold each release lever down and move the

carriage full length of travel. Pawls must not drag on escapement rack.

### 13. Ribbon Mechanism

Should feed two teeth on cloth ribbon machines and reverse on first type bar stroke after ribbon reverse lever is actuated. Carbon ribbon feed should feed and guide ribbon properly. Check ribbon track at various impression settings.

### 14. Paper Feed

- a. Check for wrinkling or slippage of paper, or stencils if used.
- b. Paper release must free paper so it can be moved easily for removal or straightening.

### 15. Typing

- a. Check operation of the keyboard by testing each key twice, at both limits of impression range. This is not an impression check.
- b. All type bars must operate freely and give uniform alignment and impression at the prescribed impression settings.
- c. Check for proper motion -- HhHhHhHh.
- d. Check for proper space bar operation -- a b c d e f g h i j k l
- e. Prepare alignment sample (Copy Factory Strike-up).

### 16. Multiple Copy Control

Check for ring and cylinder at zero setting.

### 17. Escapement

- a. On the Executive Machine, check for even meeting between all selector bars and selector bails.
- b. Check for escapement operation over entire carriage travel.

### 18. Line Lock

Test for operation.

If the machine has been ordered with any special features, such as a special-purpose platen, special type, repeating cams, etc., a check should be made of these features.

### Mounting Machines

Should the customer require that the machine be mounted to a desk, the following procedure may be used.

Figure 3 shows two methods of mounting machines in drop-well desks.

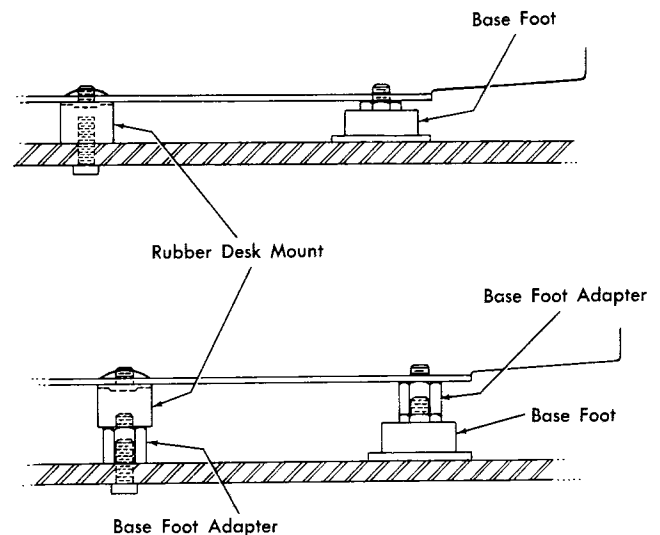


Figure 3. Mountings for Drop Well Desks

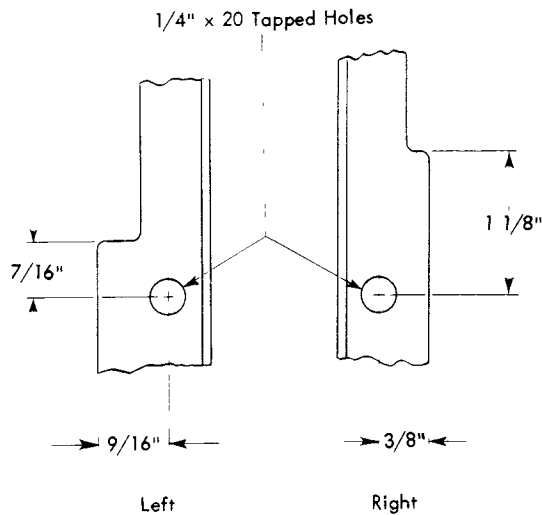


Figure 4. Locating Mounting Holes

Figure 4 shows the location of mounting holes if they are not provided in the side frames.

Location of mounting holes in the desk may be made in the following manner: Place the typewriter and pad in the desired position; raise the typewriter top cover and, using a pointed cam-bearing wire as a center punch, locate the mounting hole positions from the top of the machine, through the typewriter mounting holes.

If positioning pins are used for mounting purposes, a steel carriage roller will serve as a spacer over the threaded end in order to prevent the screw from protruding through the base far enough to cause interference with the drive belt.

Mounting on General Fireproofing desks with the swivel platform can be accomplished by using the base foot assembly of Model 01 Typewriters with the metal insert and metal socket used with the Toll Billers. In order to obtain sufficient clearance beneath the typewriter, it is necessary to use 3/16 inch spacer 50080 between the feet and the typewriter (Figure 5). To obtain maximum support, the metal sockets should be attached at a 45-degree angle as shown.

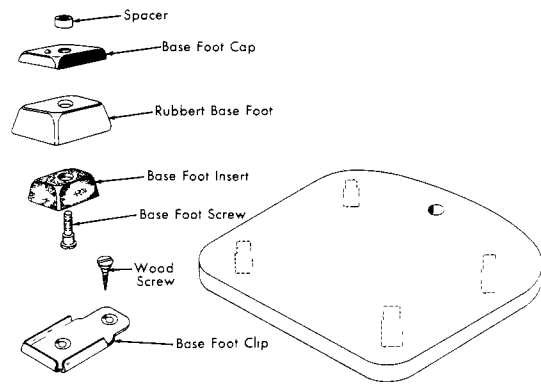


Figure 5. Swivel Platform Mountings

### Warranty Policy

IBM Electric Typewriters, in all models, are guaranteed for ninety days. Typewriter motors are guaranteed for one year. List parts are replaced free of charge, except for rubber parts, and type will be replaced, with limitations, during the warranty period. Maintenance codes 3 (Warranty) and 12 (Factory Error) may be used to charge maintenance calls only during the warranty period.

### Maintenance Agreement

A Maintenance Agreement is a contract which IBM offers to its customers to insure proper maintenance of purchased ITR and ET equipment.

The ET Maintenance Agreement provides for four inspections per year by our Customer Engineers at which time the equipment is repaired and adjusted and broken parts replaced, as stipulated in the agreement. Emergency service is furnished subject to conditions expressly stated in the contract. On Maintenance Agreements where equipment is located beyond a certain distance from the IBM office, a trip rate per inspection, or emergency call, must be added to the base prices, in accordance with instructions to the branch office.

## Inspections

An inspection is a preventive maintenance call which affords the Customer Engineer an opportunity to locate potential trouble and to take the necessary corrective steps before the trouble becomes an emergency call.

The procedure prescribed for checking new machines on page 9, may be used as a guide in performing inspections. Reference should also be made to the lubrication chart, page 144, for information as to proper lubrication. The operator should be questioned as to the machine's performance so that the Customer Engineer may not overlook any item which might cause dissatisfaction.

When an inspection has been completed, it should always be properly recorded. Average time for the inspection and lubrication procedure is forty-five minutes.

## ASSISTANCE TO THE OPERATOR

Information regarding the electric typewriter and its operation is of utmost interest to the operator. A pamphlet of operating instructions is provided with each machine, salesmen spend considerable time instructing operators and the operators themselves develop techniques and short cuts that aid materially in easing their work.

However, the customer engineer is in the best possible position to transmit ideas and information to the operators. He is a technical expert on the subject of the electric typewriter, he can secure information regarding applications from all the accounts in his territory, he has trained himself to analyze the problems that the operator is likely to meet and has developed preventive measures for a great number of operator troubles.

Some of this information can be passed on to operators at the time of installation or on an initial service call, with a view to establishing preventive maintenance and a better working arrangement between the operator and the customer engineer.

## Removal of the Platen

The operator should be instructed to be especially careful not to damage the index pawl spring when removing the platen. Unlatch the right end first and slide the platen slightly to the right during removal. The operator should be advised of the ill effects of stencils on platens and feed rolls, requiring that the platen and feed rolls be cleaned frequently on such applications.

## Removal of the Deflector

The operator should be shown how to remove and replace the deflector. Service calls can result when the operator does not seat the deflector yokes properly in the grooves of the equalizing shaft.

## Paper Bail

Show the operator how the type may overprint if the bail is left up. Also explain how the bail rolls can pick up ink from the typed surface and transmit it to clean surfaces. Bail rolls should ride the margins where possible and should be kept clean.

## Multiple Copy Lever, or Platen Guide Arm

The multiple copy lever should be demonstrated by adding a few sheets of paper behind a sheet on which a line has been typed using upper and lower case characters. After the additional paper has been inserted, the upper case letters will tend to smear. Move the lever back, one place at a time, until the capital letters become clear and

the lower case letters print clearly as well. Move the lever all the way back and show the operator how the typing disappears.

### Tabulated Columns

Explain that the operator should first clear off all stops before making a new setting. This will insure that no stops are partially set. The set button should be depressed completely when setting tab stops.

### Ribbon Installation

To help insure service free operation of the ribbon mechanism, the operator should be carefully instructed in the installation of fabric ribbons as follows:

1. Wind all ribbon onto the left-hand spool.
2. Remove the left-hand spool.
3. Move the empty, right-hand spool to the left-hand side, first observing that the left-hand feed pawls are pushed down.
4. Install the new ribbon spool on the right-hand side, this time making sure that the right-hand feed pawls are pushed down.

The ribbon feed pawls may be moved down by means of the small lever projecting up on either side just outside of the spools. Pushing down on either of these levers, moves the pawls down, out of engagement with the spool and makes it much easier to install ribbon spools.

Show the operator the effects of the ribbon control button and how to find the proper ribbon position for typing stencils.

If the machine has a carbon ribbon attachment and fails to feed ribbon, show the operator how the stencil control lever inside the left-hand magazine operates. Explain the feed and no-feed positions.

The operator should be shown what to do if the machine fails to start. Check the power cord to see that the machine is plugged in, then, on the chance that a number of functional cams have been released at the same time, so as to jam the power roll, show the operator how to tilt the machine back and rotate the driven pulley with the switch off.

### Impression Control

Type faces should be cleaned frequently, preferably dry, and dirt should be kept out of segment.

The operator should be instructed in the proper use of the impression control lever and not leave it always in the same spot for all types of work.

It is physically impracticable to attempt setting the impression at a given figure for all machines and demand identical results. Power roll speed would have to be exactly identical on all machines as would ring and cylinder adjustment on each type bar, the inking and age of all ribbons, the carbon coating of all carbon paper, the hardness and resilience of all platens, the texture and fiber of all papers and the effective lubrication of all machines. Since these features cannot be matched machine for machine, nor even between applications on the same machine, it is essential to have the operator learn the advantage of setting the impression indicator at a different point each time the machine is used for a different application, then increase the setting by one or two points to insure continued operation.

The tendency on the part of operators is to set the impression control too light and then to report failure when an occasional character prints light.

Special care and treatment of stencils are discussed in the appropriate section of this manual. Operators should be advised against typing on a cold stencil or on a stencil when the platen is cold. The wax in the stencil becomes brittle when it is cold and excessive cutting results.

Poor impression on plates can result from oxidization. Finger prints on plates or paper can also cause poor impression even though the prints are not visible.

The quality of paper is an involved subject, the aspects of which can best be explained if the operator is required to use a paper which displays brittle characteristics and tends to cut through. Brittle paper forces the operator to reduce impression to the point of impression failure resulting in light and dark impressions. This fault can be overcome by using a softer platen for the brittle paper than for other applications. Another expedient is to place a sheet of thin, tough tissue directly behind the brittle original. If the operator objects to the time involved in this operation, a carbon sheet can be secured which possesses the same thin, tough qualities and at the same time serves to make the usual carbon copies.

The subjects of paper and plates are discussed in other sections of this manual.

### Shift

A rare type of operator trouble, which becomes evident on certain characters only, is called beating the shift. It consists of depressing the type key button at almost the same instant as the shift key is depressed so that the type prints

before the shift has completely positioned the type basket. The shift mechanism may be in perfect adjustment. Correction may be made by asking the operator to change the timing of the operation.

### Carriage Return

Evidence of beating carriage return shows up when an occasional type impression appears less than a space to the left of the proper margin, in the so-called overbank space. The operator must be requested to alter the timing sufficiently to correct the error.

### Tabulation

The tabular latch and rebound adjustment must be perfectly set and, if the operator still has difficulty, then a change in the timing of tabular - typing operation must be requested. Beating tabulation occurs when the operator types before the carriage has settled after tabulation and generally appears less than a space ahead of the proper position.

### Transposition of Characters

Operators sometimes have this difficulty for short periods of time, after which the trouble disappears without apparent reason. Common combinations of letters, which have become very familiar to the operator, will suddenly and unexpectedly appear transposed, reversed in order such as "and", "the", etc., becoming "adn", "teh", etc. At the same time that letter transpositions are taking place, the space operation is also transposed with the typing operation, so that, in addition to the errors shown, some errors will look like "a nd", "th e", etc., where the space has dropped into the word within a space of the end of the word. The complaint on this trouble will probably be that

extra spaces are creeping into the work or that the space bar action is sluggish and spaces occur too late.

The correction of this trouble rests with the operator, but the entire type, universal bar, escapement system must be carefully examined first for any possible defect.

Champion speed typists sometimes experience transposition for brief periods. Correction is made by running a slow line of the offending letter combinations until they have re-established timing and their fingering of the keyboard.

This is not to be referred to as practice but rather as regaining proper timing.

## MECHANICAL PRINCIPLES OF THE ELECTRIC STANDARD TYPEWRITER

### Motor Drive

The motor used in Standard and Executive machines is rated approximately 1/40 HP whether designed for AC or DC operation.

The AC motor is of the permanent split capacitor type, operating on the induction principle (Figure 6). A condenser in the starting circuit provides a means of starting the motor in the proper direction. No brushes or starting contacts are required, thus assuring quiet operation.

The switch is operated by a switch lever and link on the right side of the frame. The switch lever operates the key lever locking bar so that key levers will not be actuated while the motor is turned off. Switches for governor controlled DC motors also serve to alternate the polarity of the current passing through the governor contact points. This is done to preserve the contact points in good condition for a longer period of time, because current arcing across a pair of contacts constantly in the same direction would tend to cause the points to pit. The governor of the DC motor operates on centrifugal force so that when the motor reaches a certain speed, the force is sufficient to move a weight which, in turn, breaks a set of contacts and puts a resistor in the circuit. The resistor reduces the current flow until the reduced motor speed causes less centrifugal force, and the contacts remake.

DC motors of the shunt-wound type require only a simple switch circuit.

The V belt tightener, in the form of an idler

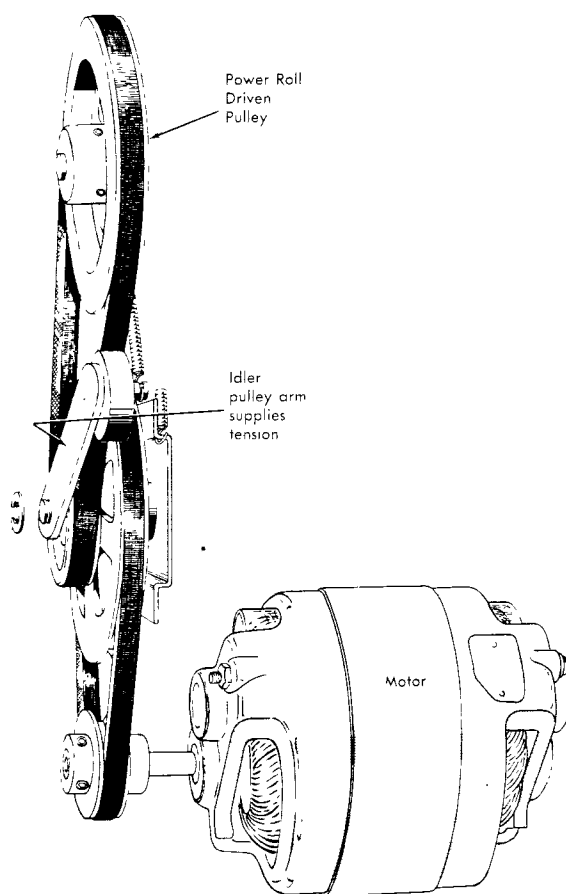


Figure 6. Motor Drive

pulley with a spring, maintains constant tension on the belts.

The power roll, driven through V belts by the motor, provides power for all functions of the typewriter by means of cams which are tripped to engage their serrated surfaces with the rubber of the power roll. The clutch for carriage return takes its power from the right-hand end of the power roll shaft by means of a friction disc.

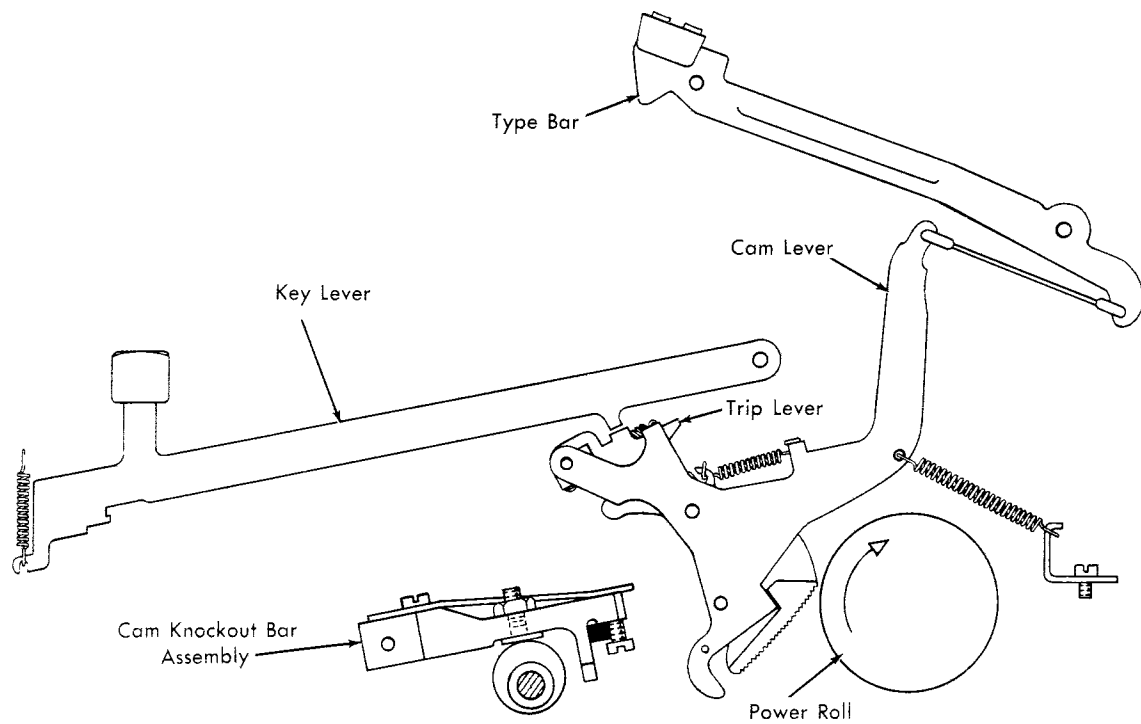


Figure 7. Cam and Type Bar - Rest Position

### Letter Cams and Key Levers

Depression of the key lever pushes the cam trip lever down against the nylon cam, causing it to engage the power roll (Figure 7).

As the cam is rotated, it causes a pull on the cam lever which, in turn, operates the type bar through its link. At a predetermined, adjustable point the tail of the cam meets the cam knockout finger, forcing the cam to leave the power roll (Figure 8).

When the key lever restores, it must rise high enough to permit the cam trip lever to restore by sliding back into its original position. A repeating cam may be installed which will vary from the standard letter cam in that the cam will re-engage the power roll each time the type bar restores to rest, as long as the key lever is held down.

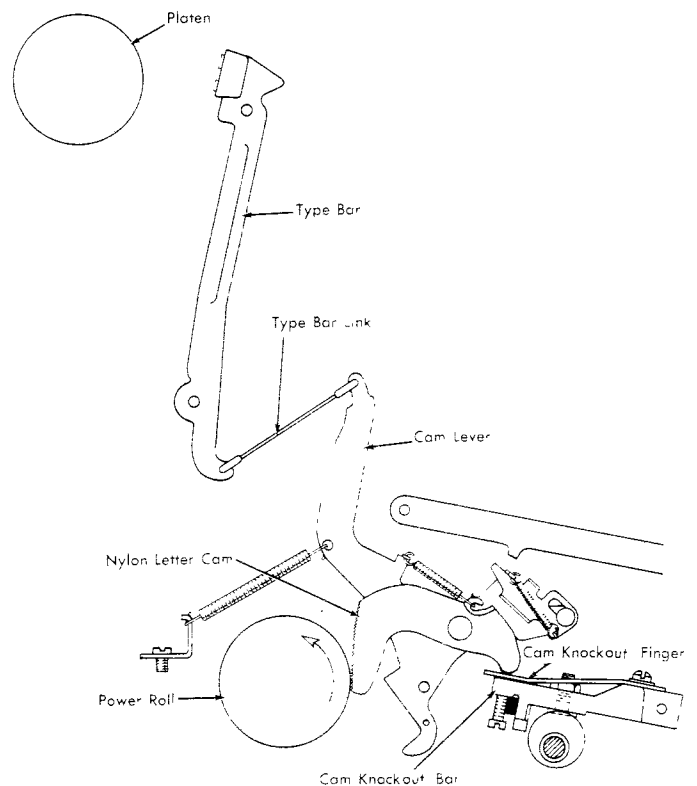


Figure 8. Cam Knocking Out

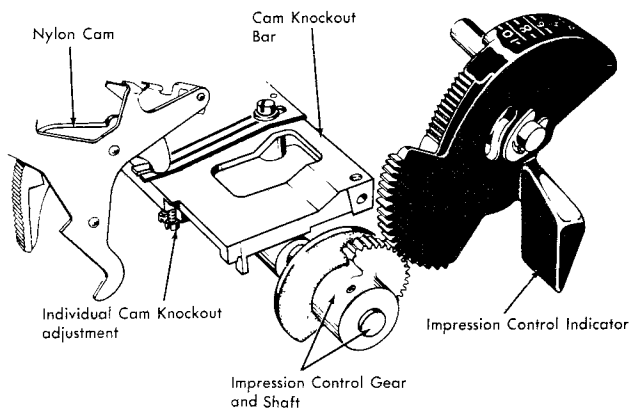


Figure 9. Impression Control Lever

An impression control lever (Figure 9) is available to the operator, providing her with a means of regulating the knockout point of the cams as a group.

#### Line Lock

The line lock bar, when actuated by the line

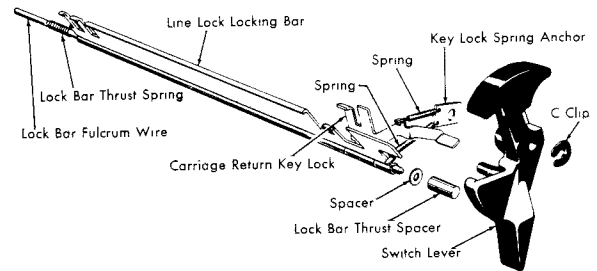


Figure 10. Line Lock

lock mechanism, prevents operation of the letter keys but permits operation of the functional keys (Figure 10). The same bar is designed to slide to the left, when operated by the cam surface of the plastic switch lever, so that it locks all of the functional keys, except the shift, in addition to the letter keys.

The line lock is a regular feature of all but the Executive Typewriters. The key lever locking

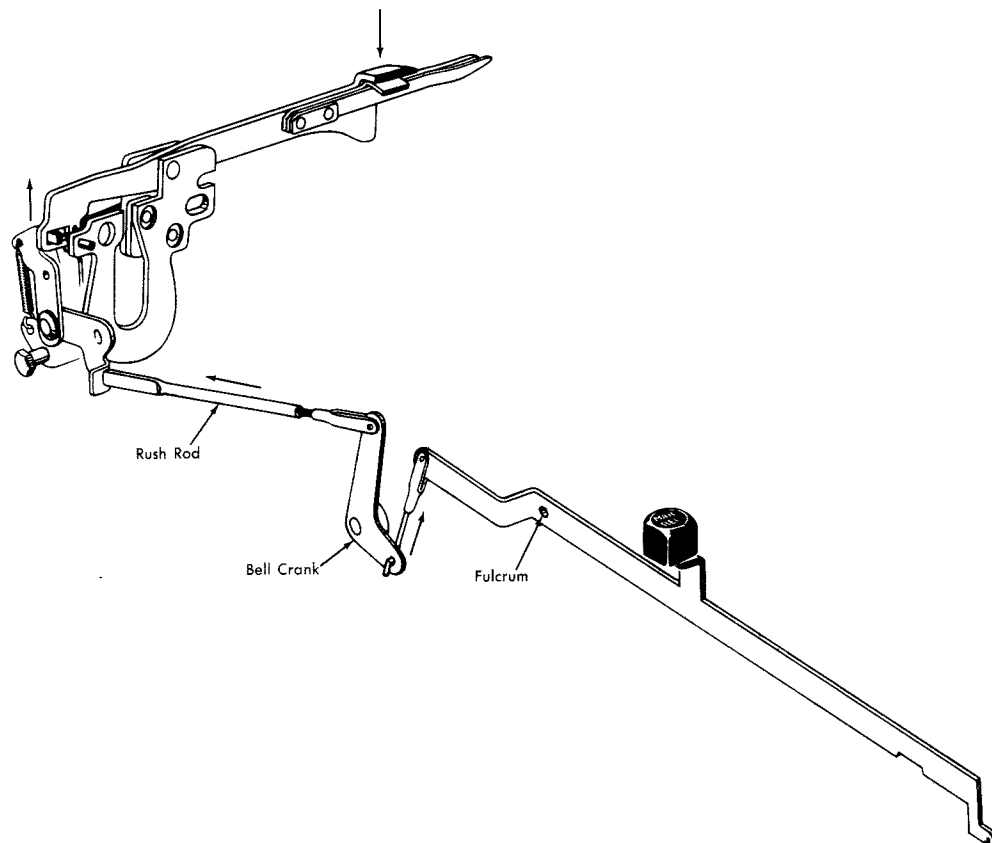


Figure 11. Margin Release

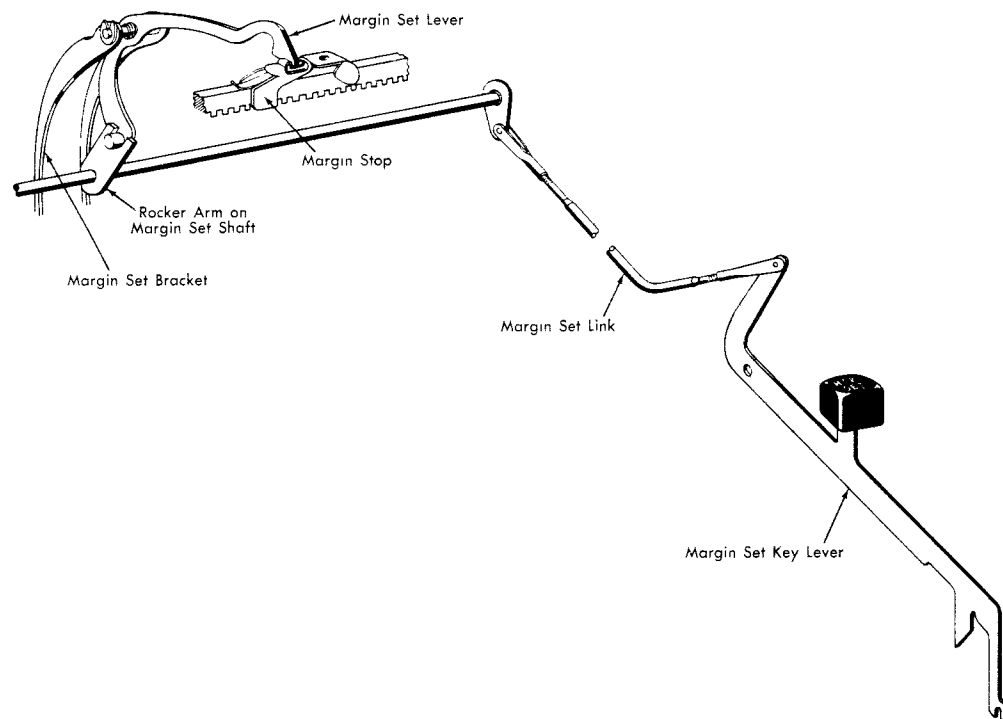


Figure 12. Margin Set

bar is a regular feature of all machines. The line lock bar is formed so that if a key has been held depressed at the time that the line lock is actuated, the key will be held down until the line lock is released.

The parts utilized in the key lever locking bar arrangement are interchangeable on all machines, except those which employed a locking bar made up of spring fingers. Such machines would require replacement of the key levers in order to adopt the formed locking bar. An intermediate design provided a locking bar with stronger spring fingers.

#### Margin Release

A margin release button (Figure 11) on the keyboard, operates through linkage to depress the tab lever so as to permit the margin stops to override the tab lever and pass the set margin stops.

#### Margin Set

A margin set button on the keyboard actuates a lever on the rear of the machine (Figure 12). The operator may move the carriage to either margin and depress the margin set button. Moving the carriage, with the margin set button depressed, alters the setting of the margin stop. An interlock under the margin set key prevents the operation of carriage return or tabulation during the margin set operation.

#### Type Bars

As the cam is operated by the power roll, the type bar is driven toward the platen (Figure 8). The type face is curved to the same arc as that of the platen so that all parts of the type face will strike squarely. To insure a clean, even impression, the type bar has been designed and adjusted to strike the anvil, or ring, just before the type face strikes the paper. The amount of

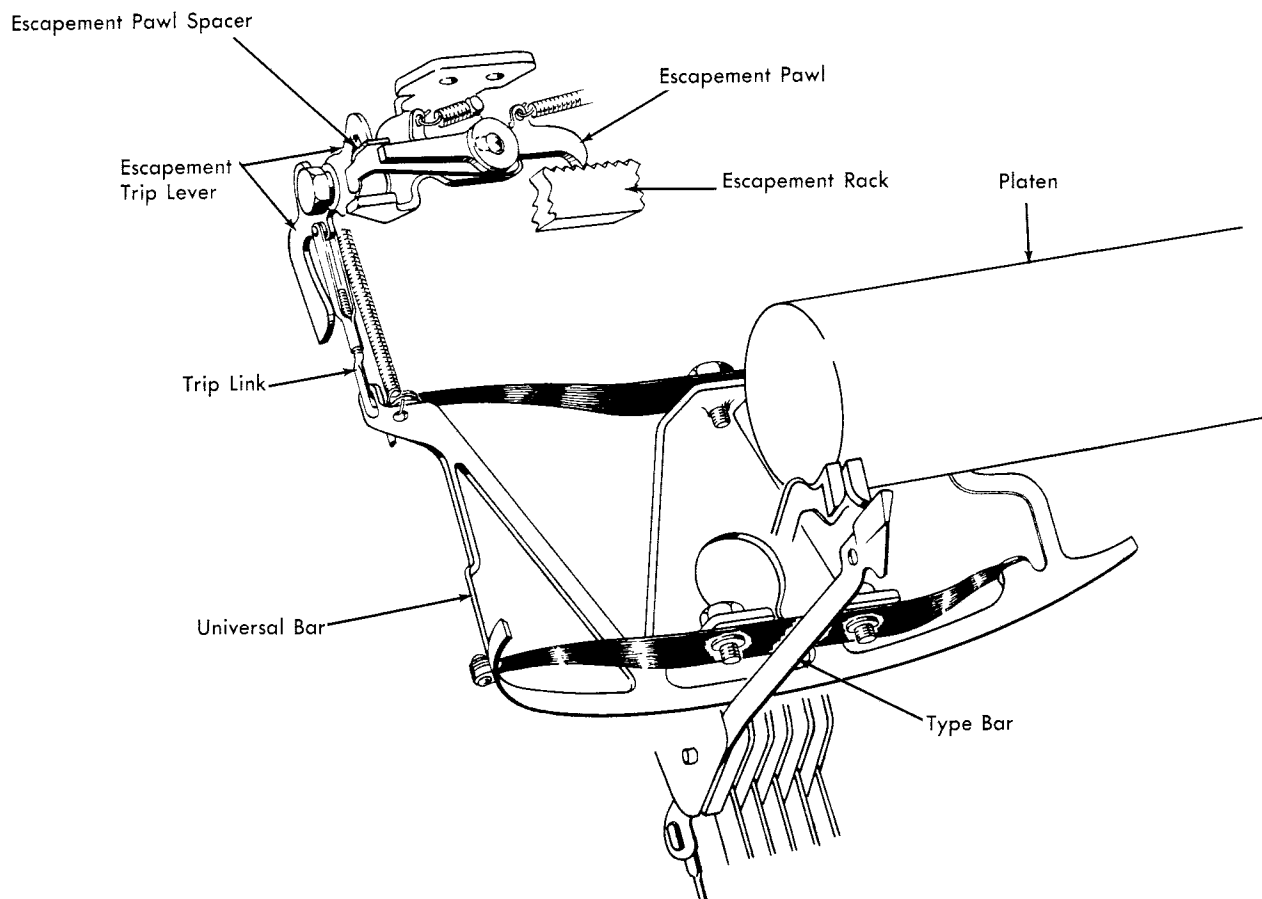


Figure 13. Escapement Mechanism

"whip" necessary to prevent the type face from lingering on the paper long enough to smear or cause a fuzzy impression will depend on both the strength of impression and on the width, or boldness of the type face. The subject will be discussed in detail in the adjustment portion of this manual.

### Escapement

The escapement in the standard machine employs a single pawl operating in a rack, the teeth of which are spaced to the same dimension as the pitch of the machine, e.g., the rack in a ten-pitch machine carries ten teeth to the inch, etc. As the type bar is driven toward the platen, it contacts the universal bar and pushes it toward the rear of the machine (Figure 13).

The escapement trip link and trip lever are operated by the universal bar, causing the escapement pawl spacer to push the pawl out of the escapement rack. The pawl spring pulls the pawl to the next rack tooth as soon as the pawl leaves the rack. The carriage main spring tension pulls the carriage to the left where it

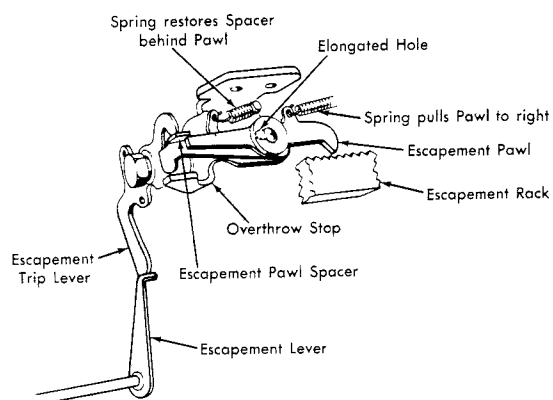


Figure 14. Space Bar Escapement Action

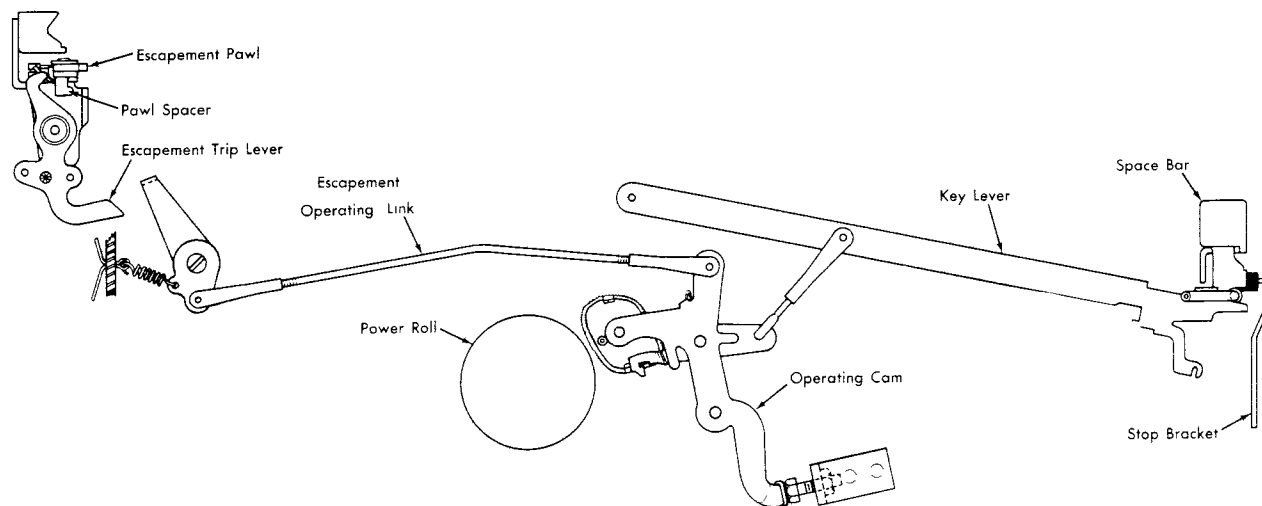


Figure 15. Space Bar Mechanism

is caught and held by the escapement pawl, engaged in the rack. The escapement may also be operated by the action of the space bar as shown in Figure 14.

#### Space Bar

Depressing the space bar trips the space bar cam unit, causing the cam to engage the power roll (Figure 15). Leverage developed on the cam frame pulls the escapement operating link and causes a small lever to strike the escapement trip lever, actuating the escapement pawl and permitting the carriage to travel one space under tension of the main spring.

#### Carriage and Rails

The carriage is supported on truck roller assemblies that permit it to roll freely along the rails. The trucks are retained by star wheels (Figure 16) which engage a rack on the bottom of each rail and on the top edge of each of the carriage ways. Final stops on the ends of the carriage strike the final stop plate on the front rail and prevent the carriage over-riding after the margin stops have been passed.

#### Shift

The shift mechanism, on the right-hand side of the machine, is operated by a pusher lever which receives its power from the shift cam (Figure 17). As the key is depressed, the pusher is positioned in line with the upper of two pins on the actuating plate, or shift toggle levers assembly. When the key has traveled two-thirds downward, the cam is released, causing the pusher to act against the upper pin in such a way as to rotate the actuating plate and pull the type basket down into the upper case position. Releasing the key permits the pusher to position in line with the lower pin just as the second lobe of the cam is released, thus causing the actuating plate to rotate in the opposite direction and to

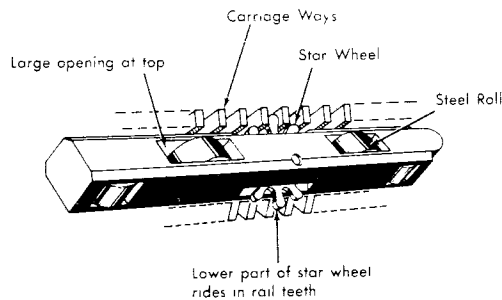


Figure 16. Carriage Truck Assembly

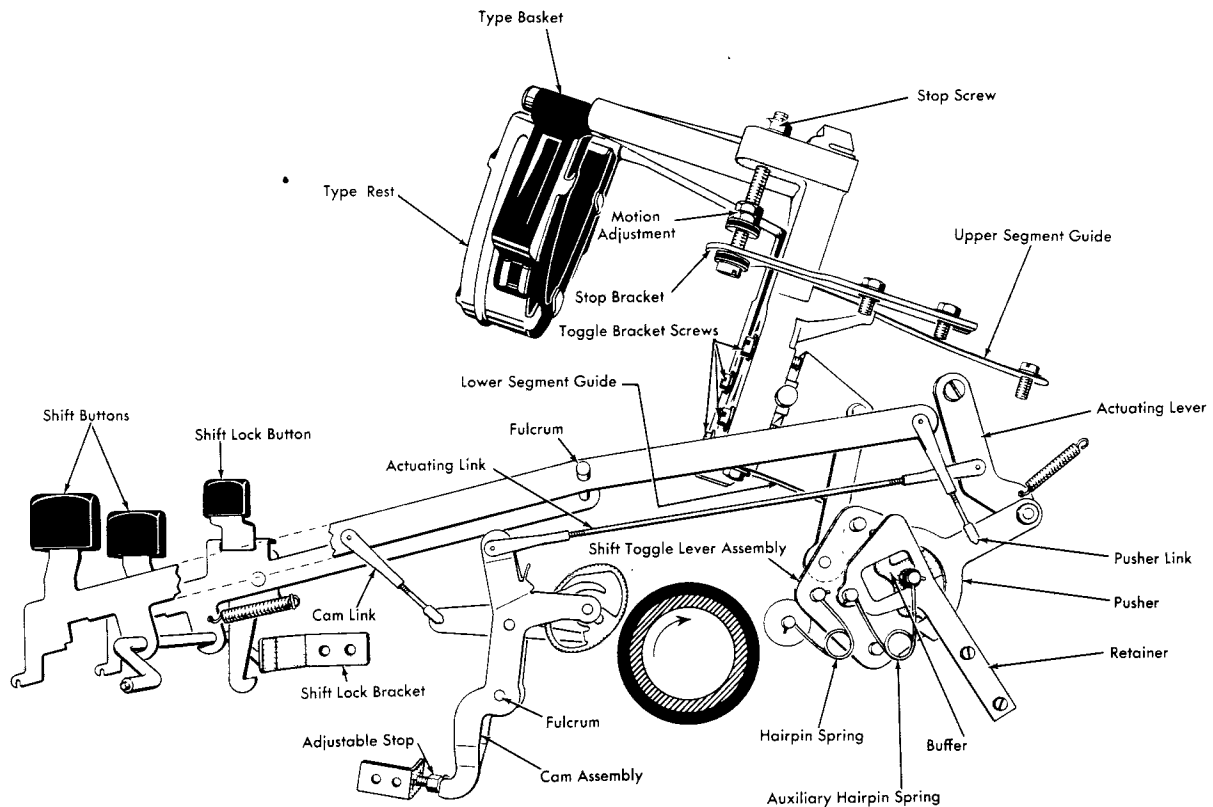


Figure 17. Shift Mechanism

push the type basket back up into the lower case position. Hairpin springs are employed to complete and hold the basket shift motion.

Just behind the pusher is a buffer which catches the opposite pin. The buffer returns to rest position under impulse of the pin and under tension of the actuating lever spring but, since the cam has been designed with a receding serrated surface on the back, the buffer will restore to rest no faster than the cam will permit. This design prevents the shift basket from dropping noisily into position.

### Paper Feed

The platen is supported by sleeve bushings on adjustable yokes, called platen guide plates, which permit the operator to set ring and cylinder according to the number of copies being used (Figure 18). A suitable gage as to where

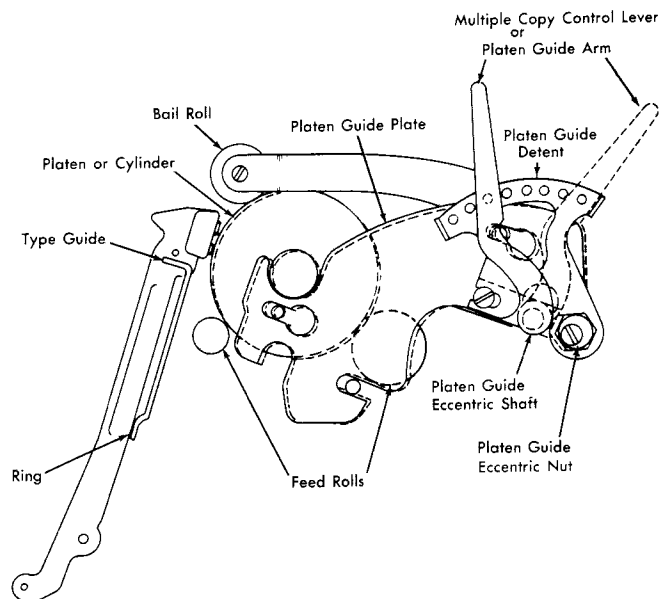


Figure 18. Multiple Copy Lever

the operator should set the multiple copy lever is to observe the print of upper case characters. If the upper case of some characters appears somewhat fuzzy in spite of a good average ring and cylinder adjustment, the operator may move the multiple copy lever toward the rear one notch at a time until the impression is clear. A check of the lower case characters should be made to insure that their impression is still good.

Paper is fed by the platen as it is rotated. Pressure of the paper against the platen is maintained by feed rolls mounted in deflector yokes under the platen. Compression springs supported by screws in the carriage base provide the necessary lift, assisted by a torsion spring attached to the left-hand end of the feed roll actuating arm.

Paper release is accomplished by moving the paper release lever toward the front. This action moves a toggle lever assembly on the left-hand end of the carriage so as to rotate the feed roll actuating shaft downward toward the rear. The feed roll actuating arm will be lowered, causing the deflector and feed rolls to drop away from the platen.

#### Platens

Platens are supplied in various sizes and grades of hardness for different types of work. In order to establish the number of carbon copies that may be written on any grade of platen, the following factors must be carefully considered: weight of paper, weight of carbon paper, size and face of type, and the size and grade of platen. In general, information given here will prove useful in selecting the proper platen.

No. 1 Standard diameter and hardness for general typewriting applications and stencil writing using most type faces. For the Executive typewriter with carbon ribbon

and IBM Secretarial type, PS, style No. 26, IBM Text Type, PH, No. 47, IBM Charter Type, PR, style No. 51 and similar types. On any of these applications, however, if a sharper write is desired, a No. 2 platen is recommended.

No. 2 Standard diameter platen, slightly firmer than No. 1 for use on general correspondence and some stencil applications. For type styles No. 11, Pica Book, A and No. 13, Large Pica Book, LP. For Executive typewriter with carbon ribbon and IBM Modern type PM, Style No. 32, IBM Copperplate Gothic type, PG, style No. 46, IBM Mid-Century type, PF, Style No. 50, IBM Documentary type, PE, Style No. 40, and IBM Secretarial type, PS, Style No. 26 with a cloth ribbon.

No. 3 Hard platen of the same diameter as the No. 1, for writing a small number of carbon copies requiring sharp impression. This platen is not suitable for stencil writing or similar applications.

No. 4 Hard platen, 1/32" undersize in diameter. For writing a large number of carbon copies.

No. 6 Same hardness as No. 1 but 1/32" undersize in diameter. This platen is standard on all lifting platen machines for writing a limited number of carbon copies.

No. 7 Hardness the same as No. 4 1/16" undersize in diameter. For writing the maximum number of carbon copies.

No. 8 Standard diameter but more firm than No. 2. For use with bold face types, such as type styles No. 10, Bulletin BV: No. 12, Roman Book D: No. 21, Book-

face Academic, BA: No. 27, Gothic Bulletin, GB: and for Executive Type-writer, Bold face type, PO, Style No. 16, using carbon ribbon and for PM or PE type with cloth ribbon.

No. 9 Standard diameter, slightly less firm than No. 1, designed for use with stencils because of its greater resistance to the stencil oils.

In the event that certain platens induce a cutting condition on the majority of type faces, then a softer platen should be used. If cutting or heavy embossing is noted on only a few type faces, then the offending type faces may be treated to remove any excess sharpness.

#### Ratchets and Detent Release

Platen ratchets are supplied with various numbers of teeth to facilitate selection of suitable line spacing. The Standard machine is normally equipped with a 33-tooth ratchet, permitting 6 lines per inch, and the Executive model is equipped with a 29-tooth ratchet, except in the smaller type faces. A standard 33T detent arm was provided on all standard machines until experience proved that the 29T detent arm can be made a common part for the 29, 33, 38 and 44-tooth ratchets in the following table, as well as for some other ratchets. Since the 29T detent arm has become a common part, the stamped figure 29 is not required. To avoid confusing a 29T detent arm with a 33T detent arm, compare the lengths of the two arms. The 29T will be shorter by approximately 1/64". The chart (Figure 19) shows what parts need to be changed for some of the more commonly used ratchets. The choice of a ratchet will be governed by the size of type and the amount of material required to the page. Executive type faces vary in boldness as well as size and must be typed in the

Number of Teeth on Platen Ratchet	Number of Teeth Per Line Space Operation			Number of Lines Per Inch	Special Parts Necessary
	Single	Double	Triple		
29	1			5.25	Detent Arm 29T Pawl Stop 29T
		2		2.64	
			3	1.76	
33	1			6	Detent Arm 29T (See Instruction)
		2		3	
			3	2	
38	1			7	Detent Arm 29T
		2		3.5	
			3	2.3	
44	2			4	Detent Arm 29T
		3		2.6	
			4	2	
44	1			8	Detent Arm 29T Pawl Stop 62T
		2		4	
			3	2.6	
55	2			5	Detent Arm 55T Pawl Carrier 62T Pawl Stop 55T
		3		3.3	
			4	2.5	
62	2			5.6	Detent Arm 62T Pawl Carrier 62T Pawl Stop 62T
		3		3.8	
			4	2.8	
66	2			6	Detent Arm 62T Pawl Carrier 62T Pawl Stop 62T
		3		4	
			4	3	

Figure 19. Platen Ratchets

correct line spacing to present a proper appearance. Experience has indicated the following combinations as satisfactory although customer preference may dictate other ratchets.

Type	Ratchet
16 Bold Face (PO)	29
26 Secretarial (PS)	29
32 Modern (PM)	29
40 Documentary (PE)	29
46 Copperplate Gothic (PG)	29
47 Text (PH)	33
50 Mid-Century (PF)	29
51 Charter (PR)	33

The detent release lever provides the operator with a means of temporarily disengaging the line

spacing detent so as to permit writing above or below the normal writing line (Figure 20). By merely restoring the detent release lever, the platen is restored to its previously selected writing line and continues its normal line spacing.

### Carriage Return

The carriage return key lever releases the single lobe cam at the extreme right end of the power roll to engage the power roll and lock the clutch through the linkage to the clutch lever (Figure 21). By means of linkages between the clutch latch and the knockout lever on the rear rail, the lever is raised simultaneously with the

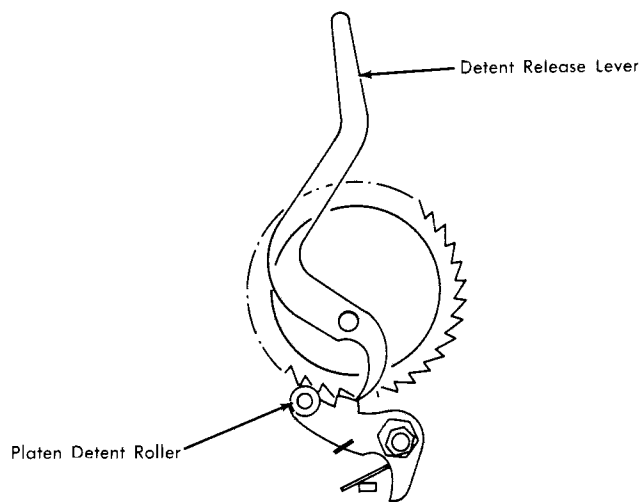


Figure 20. Detent Release

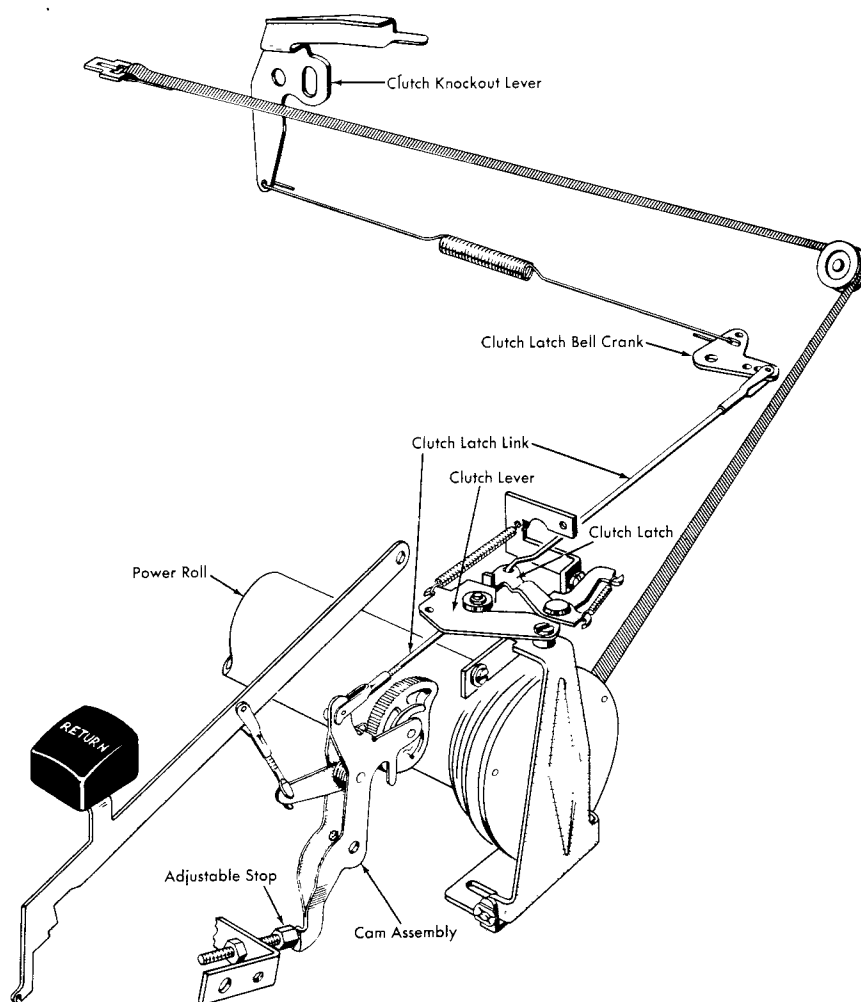


Figure 21. Standard Carriage Return

latching of the clutch. The escapement pawl is disengaged from the escapement rack by the same motion. The clutch operating arm is moved against the clutch plate by this action; this causes the clutch friction disc to engage the clutch pulley and, by rotating the pulley, causes carriage movement to the right by winding up the carriage return tape.

The carriage will continue to return until the margin stop engages the clutch knockout lever, which causes sufficient tension through the linkage to unlatch the clutch and return the cam to its normal rest position.

### Line Space Operation

The initial pull on the carriage return tape operates the platen indexing mechanism through the medium of the hook lever assembly and the index pawl carrier assembly to cause the pawl to enter a platen ratchet tooth and rotate the platen (Figure 22). Provision is made for spacing different numbers of ratchet teeth with each operation of the line space mechanism by changing the position of the line space lever to vary the position of the index pawl and allow it to enter the ratchet at a different point. An adjustable stop is provided to prevent overthrow.

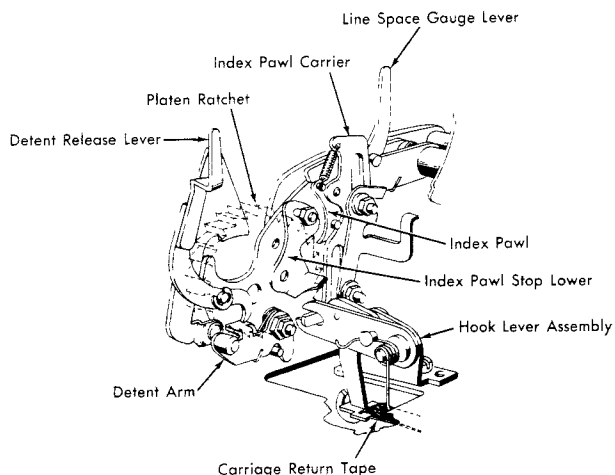


Figure 22. Line Space Mechanism

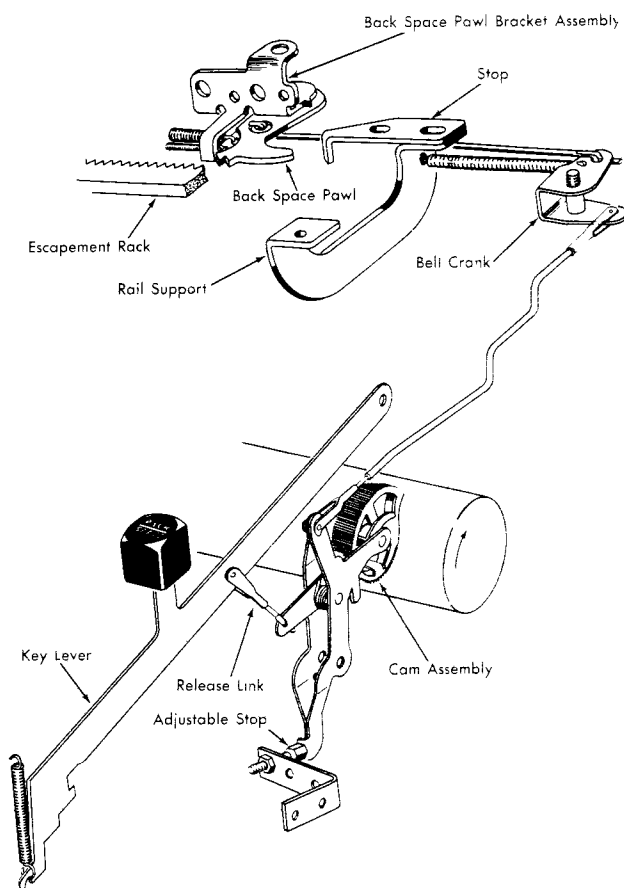


Figure 23. Back Space Mechanism, Standard

### Back Space Mechanism

Depressing the back space key releases the cam which then engages the power roll. Leverage developed on the cam assembly frame pulls the operating line (Figure 23), causing the bell crank to rotate and pull the back space link. The back space pawl is mounted on a diagonally cut hole in its base; as the pawl is pulled to the right, it is cammed into the escapement rack. Two springs attached to the head of the back space pawl cause the head to delay any movement to the right until the pawl is engaged in the escapement rack. Upon engagement with the rack, the continuing pull of the back space link on the pawl pulls the carriage to the right until the escapement pawl is permitted to snap into the next tooth of the escapement rack. At this point the back space

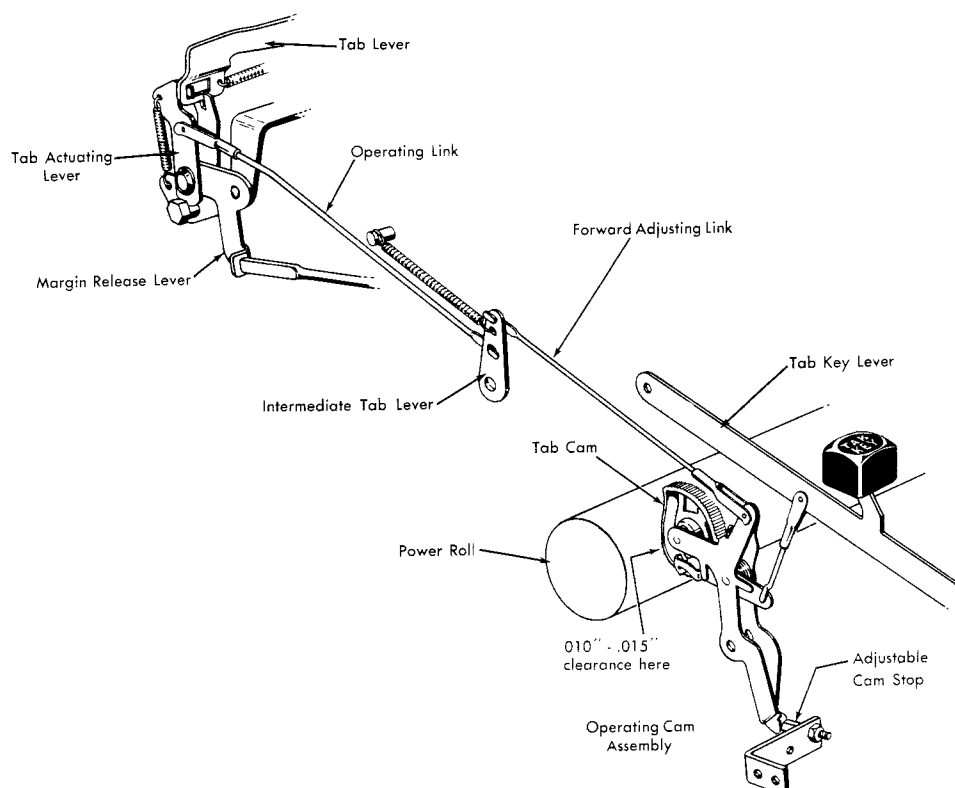


Figure 24. Tabular Mechanism

pawl is halted by the back space pawl stop; the pawl, in turn, halts any further motion of the carriage to the right. An interlock, actuated by the pawl release lever, blocks the back space pawl during any operation of carriage return, tabulation or carriage release. The interlock also serves to stop carriage return, tabulation or carriage release during the time that the back space pawl is operating.

#### Tabular Operation

The tabular mechanism is a device to permit the operator to place typing in accurate, orderly columns, at a minimum of two spaces between columns. Depression of the tabular key releases the tab cam, permitting it to engage the power roll. Leverage developed by this engagement is transmitted by linkage to the left end of the rear rail and pulls the tab actuating lever forward (Figure 24).

The tab lever is operated by the actuating lever to move far enough toward the rear of the machine to permit a small latch to spring in front of it and hold the tab lever out. One of the lugs on the pawl release lever is in a position to be caught by the tab lever; the escapement pawl is thus pulled, and held out of the rack as long as the tab lever remains latched out. When the pawl is out of the rack, the carriage is free and begins to travel toward the left under tension of the main spring.

Attached to the main spring drum is a felt ring which acts as a brake when pressed by a large ratchet plate called the friction governor plate. An adjustable spider spring provides the necessary pressure to control the speed of the carriage during tabulation.

The tab governor is in operation only during tabulation; this is due to a pawl actuated from

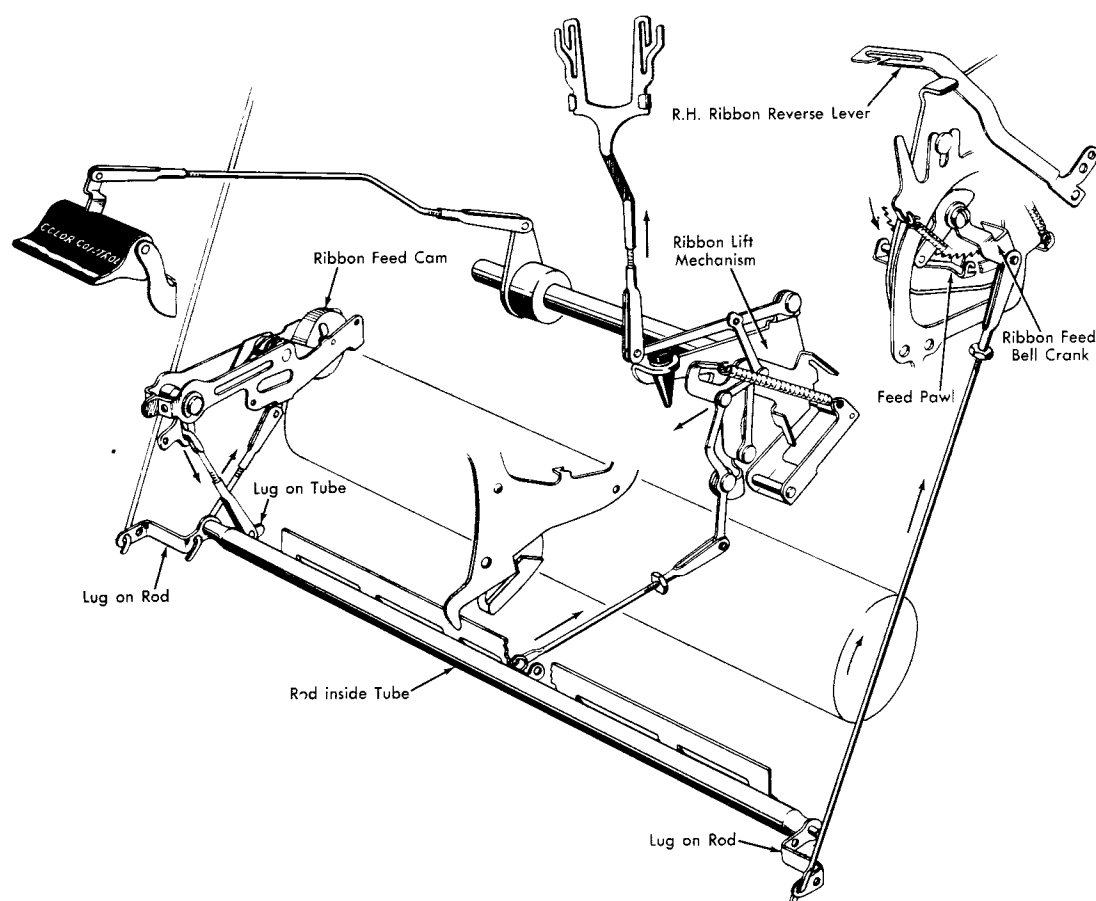


Figure 25. Ribbon Control

the left end of the tab lever, which engages the ratchet only when the tab lever is latched out. The pawl is mounted on elongated holes to permit a few spaces of free travel to establish momentum before it halts the rotation of the friction plate.

A rack of stops, called the tab rack, permits selection by the operator of any stop desired. When the carriage has traveled to where one of its tab stops meets the tab lever, the tab lever is moved to the left on its elongated mounting hole until it falls off the tab latch. As the tab lever resumes its rest position, the escapement pawl enters the escapement rack and holds the carriage at the selected position.

To prevent the carriage bouncing back to the right, a rebound check lever is mounted on the

top of the rear rail, to the right of the tab latch. The rebound check lever is actuated by a leaf spring on the tab lever and is moved into position as the tab lever moves out onto its latch. As the tab stop pushes the tab lever to the left, the rebound check lever is snapped into check position to the right of the tab stop, preventing the stop from bounding back in that direction. Since the tab lever is mounted on an elongated hole, it normally restores two spaces to the right of the selected stop. Whenever this is less than two spaces, rebound check trouble is indicated.

The rebound check lever is restored by a coil spring which is wrapped around the collar of its eccentric mounting nut. This same spring is responsible, in part, for the restoring of the tab lever.

## Ribbon Control

The ribbon feed mechanism consists of the ribbon operating bail tube extending across the bottom of the machine, a vane on the top of which is caught by any letter cam that operates, thus rotating the tube (Figure 25). A link on the left end of the tube releases the ribbon feed cam, and the leverage developed by the cam is transmitted by link to the ribbon operating shaft inside the tube. The shaft is connected by means of a link on each end to the left and right ribbon feed pawls, one of which is engaged to the ribbon spool, while the other is held disengaged. Motion is thus transmitted, causing one spool to rotate and feed the ribbon in one direction.

At the same time, the rotation of the ribbon operating bail tube causes a link and lever arrangement in the center of the typewriter to lift the ribbon into the typing position. This position is adjustable to permit the operator to

choose a color or stencil condition at will. Four positions are available.

As the spool runs empty, the ribbon becomes taut and pulls a reversing lever toward the rear of the machine. With the lever pulled back, a pawl is positioned in the path of the next feed stroke of the ribbon feed bell crank, causing the ribbon feed pawls to engage the empty spool and start winding ribbon onto it from the full spool which has simultaneously become disengaged.

## Ribbon Rewind Mechanism

A ribbon rewind feature utilizes the ribbon feed cam as a repeating cam. A slide lever, in front of the left-hand ribbon spool, may be pushed down and will carry the cam release lever beyond its normal release position. This action removes the holding lug of the release lever from the path of the cam lugs and allows the cam to run continuously as long as the rewind lever is held down.

## REMOVAL AND ADJUSTMENT PROCEDURES FOR THE ELECTRIC STANDARD TYPEWRITER

When it is necessary to remove covers, special attachments or other devices, such removal may be done, as required, without special reference in these instructions.

### Motor

The motor may be removed in either of two ways. If only the motor is to be replaced, remove the rear cover section, unsolder electrical connections and remove the V belt. Remove the adjusting screw and the screws or clips that secure the motor mounting shaft and drop the motor.

The motor may be removed, sufficiently to service its bearings and rotor, without opening its soldered connections.

The frequency rating of induction-type motors determines their speed, and due care must be observed to insure that they are connected to alternating current of the proper frequency.

To check for a defective condenser on AC, turn the motor switch on. If the free motor fails to start, spin it. If the motor will run but will not start, there is a good possibility that the condenser circuit is not complete or that the starting windings of the motor are open.

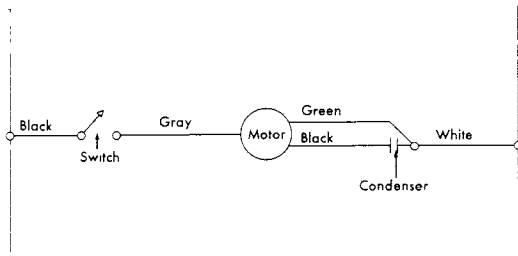


Figure 26. AC Motor Wiring Diagram

The switch link along the right-hand side of the machine is to be adjusted to take advantage of the full travel of the switch operating lever. Note that a lug on the switch operating lever travels in an elongated hole in the side of the base to limit its travel.

If a free motor should fail to run, and investigation reveals that the electrical circuit is complete, a check should be made for binds in the bearings. The self-aligning bearings are held firmly in place by steel retainers. It is possible for the bearings to be held with slight pressure against the shaft and thus interfere with the running of the motor. If such a bind is detected, a slight tapping on the side of the motor should jar the bearings into line.

If the bearings seem tight after tapping, check to insure that the shaft has .005" to .010" end play. If a bind still persists, check the condition of the shaft where it rides in the bearings. It is possible that the wrong lubricant may have been used on the oilite bronze bearings and caused a gummy substance to form on the shaft and in the bearings. This should be cleaned thoroughly and completely re-lubricated, using IBM No. 6 oil.

When a motor displays weakness, the rotor or armature should be removed and the shaft should be cleaned with a good solvent. No abrasive should be used since this would cause a rough surface which would damage the bearing. Weak motors are generally found to have a brown, burned oil deposit on the shaft in the bearings.

A weak motor may be judged so because it may have stopped under a load such as repeated line

spacing with a clutch which was adjusted too tightly. Before the motor is condemned as weak, the clutch adjustments should be examined carefully to insure that the clutch will unlock easily. If such an adjustment seems difficult and if the machine is equipped with a toggle type of clutch, then the necessary parts should be installed to convert the clutch to a latch type.

A motor may appear weak because of lack of oil. Oilite bronze bearings require that oil be available from the wicks that surround them. The dust cover should be removed to permit access to the oil well holes in each of the motor end bells. These holes should be filled so that the oil can flow down and saturate the wicks.

Lack of oil in the other oilite bronze bearings of the belt drive and power roll system may be responsible for noise or weakness. The lubrication chart on page 144 should be consulted regarding proper lubrication.

Motor noise may be traced to some other part of the machine which may pick up and amplify the natural vibration of the motor. This may be a loose paper table, paper guide or other part of the carriage or rear rail. It may even be a loose cover section. Every effort should be made to locate and correct the vibrating part. The motor vibration may be subdued by installing softer rubber mounting grommets if it is determined that those in the machine are hard. It should be noted that installation of the grommets includes a small piece of bare wire, formed in a U, around the end of one of the grommets, which serves to ground the frame of the motor to the frame of the machine. This is referred to as a static eliminator.

The term "motor noise" may sometimes be used, in error, to describe a clicking or rattling sound in the V belt drive system. A loose, rattling idler pulley bracket can be corrected by the addition of shims between the frame and

the bracket. If the motor pulley is too far in on the motor shaft, it will have a tendency to pull the idler pulley in against the frame of the machine. The motor may also be too far forward, or the V belts may be stretched, in which case the idler pulley could ride high enough to strike the cover. Moving the motor back or replacing the V belt, or both, will correct this condition.

Occasionally an operator may complain of shocks that she receives from touching the machine and her desk or other objects simultaneously. The Customer Engineer may not feel the shock by making the same contacts, nor can the operator feel them at all times. This phenomenon may be traced to a condenser action which can take place between the condenser and the condenser case. If the condenser case is in contact with the machine, then occasional surges may be built up which can be discharged in the manner described. Insulation installed between the condenser case and the machine frame serves to eliminate the fault. Operator's clothing can also be a source of static charges even with the machine turned off.

#### Shunt Wound Motor for DC

A shunt wound motor, in which speed is dependent on stable line voltage, rather than on line frequency, may be used on DC installations. The advantages of this motor are that it has no governor contacts, it requires no elaborate filter and resistor circuits and, in the event of a change to AC, only the motor need be changed.

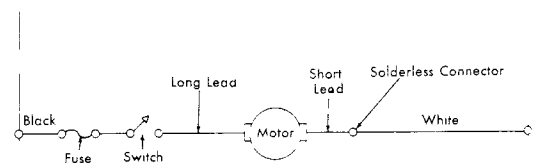


Figure 27. DC Shunt Wound Motor Wiring Diagram

The shunt wound motor is equipped with its own filter circuit within the commutator end of the case, so that any RF interference will be eliminated.

Because the shunt wound motor closely resembles the induction motor used on AC, it is recommended that the name plate be consulted before connecting the machine.

The shunt wound motor should be given the same care and lubrication as the induction motor. In addition, the natural deposit of carbon and dust which collects around the brush holders should be cleaned out every six months. The commutator should also be cleaned with crocus cloth every six months to provide a bright surface for good brush contact. Any coarse abrasive used on the commutator would cause scratches in the soft copper surface which could produce noise. Be sure that the brushes are well marked so that they may be re-assembled exactly as they have been worn in.

#### DC IBM Motor

It is necessary to install a fuse in any DC installation. A 1/2-inch hole in the right rear side of the machine accommodates the fuse holder which is inserted with the cap toward the front of the machine.

The black lead wire is to be connected to the side connection of the fuse holder. The long wire from the fuse holder is to be connected into the terminal block at the number three post (Figure 28).

Maintenance of the IBM governor-controlled motor requires that the bearings be kept oiled and cleaned, carbon dust be cleaned from around brush holders, that commutators be cleaned bright with crocus cloth, and that the governor contact points be maintained flat and smooth with a flexstone.

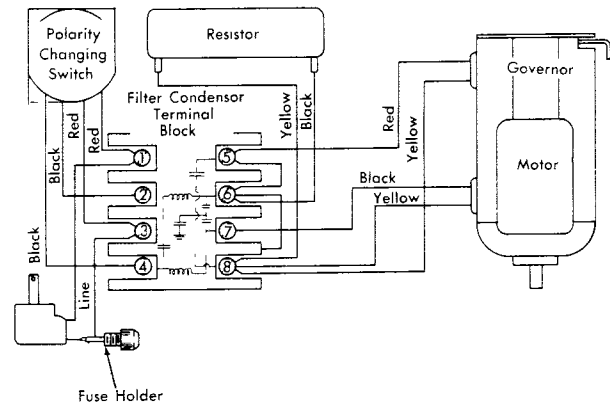


Figure 28. DC Governor Controlled Motor Installation

During disassembly the motor brushes must be so marked that they can be replaced in exactly the same position that they originally held, otherwise they will generate noise.

The governor adjusting ring must be set, by loosening the clamping screw in the end of the motor, so that the motor runs at a speed of 2500 RPM with the governor control lever in the high speed position. Motor speed must be measured with a tachometer.

End play, controlled by the number and thickness of thin steel washers on the armature shaft, must be kept to .005".

#### Polarity Change Switch

A polarity change switch is available to minimize pitting of the governor contact points on DC applications using the governor controlled motor (Figure 28).

As shown in the diagram, there are two circuits through the polarity switch. Operation of the switch moves the position of all movable contacts clockwise to reverse the direction of the current through the governor, which prevents a building up of a deposit on one point.

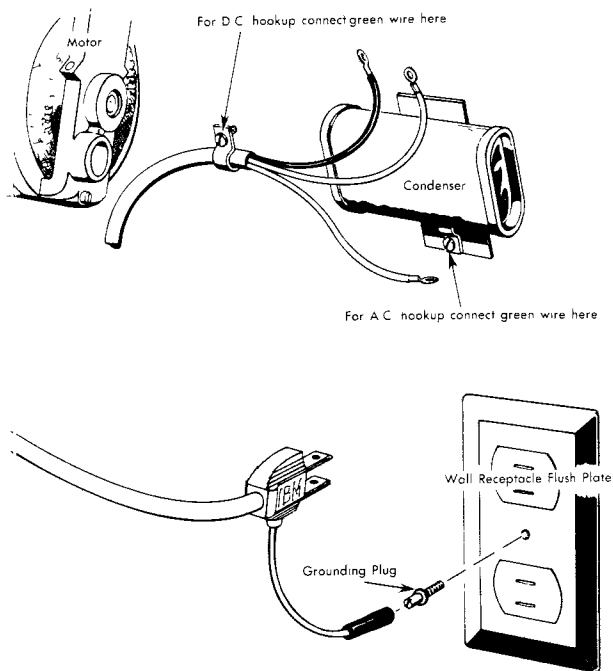


Figure 29. Grounded Line Cord

### Grounded Line Cord

The three-wire line cord provides a means of grounding the typewriter as a safety feature. The ground wire is connected (Figure 29) by removing the screw holding the flush plate to the outlet and replacing it with the ground wire plug. On AC machines the ground wire is attached by means of the screw holding the clip at the condenser, while on DC machines the ground wire is fastened by the screw which holds the line cord clip.

### V Belt Tightener

The V belt tightener provides a means of maintaining constant tension on the motor V belt, by a spring attached from the shift toggle spring stud in the side frame to the intermediate pulley bracket assembly. Tension for the driven belt is supplied by an idler pulley arm assembly under spring tension (Figure 30).

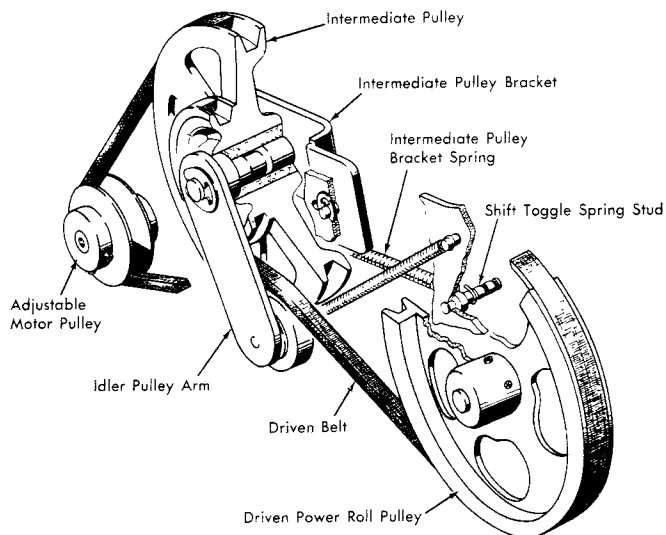


Figure 30. V Belt Tightener

On machines not equipped with this device, installation may be made, where required, by removing the belts, the intermediate pulley and its bracket. Install the necessary parts as shown.

Adjustment for the proper initial tension may be made by loosening the motor adjusting screw and moving the motor back until there is 1/8" deflection in the lower span of the driven belt.

### Power Roll Speed Indicator

When motor and voltage changes are made or whenever such is deemed necessary for any reason, the power roll speed should be checked

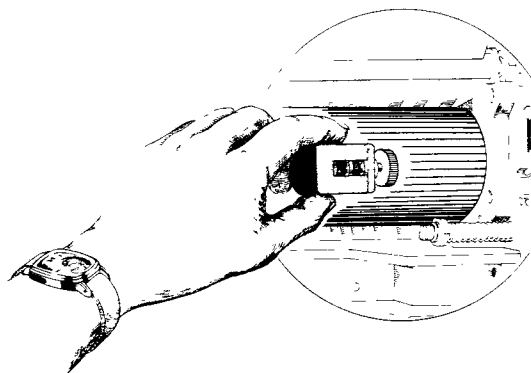


Figure 31. Power Roll Speed Indicator

with an indicator (Figure 31) to insure the best speed for the type face being used.

The motor pulley should be adjusted according to the style of the type installed in the machine. The following table will serve as a guide in adjusting for the proper power roll speed.

<u>Model</u>	<u>Power Roll Speed in Feet Per Minute</u>
Formswriter	105 + 2 - 0
All Others	95 + 2 - 0

When the machine is equipped with the modified cam knockout, the power roll speed should be 95+2-0 feet per minute regardless of type. By holding the indicator wheel against the power roll for one minute, as shown, the power roll speed is accurately recorded in feet per minute.

The speed indicator reads from 0-100 feet; therefore, a speed in excess of 100 will bring the indicator back to and beyond the zero point. The indicator may be turned back to the zero point by rotating the wheel in either direction.

If the speed indicator is not readily available, power roll speed may be checked with a tachometer after having removed the front case. The tachometer will read in revolutions per minute, and the following table may be used to convert the revolutions per minute readings to feet per minute:

<u>Feet per Minute</u>		<u>Revolutions per Minute</u>
105	=	268
100	=	255
95	=	242

In the event that neither the speed indicator nor

the tachometer is available, the power roll speed may be determined by counting the revolutions of the power roll driven pulley. The notch on the inside of the pulley rim may be detected by the tip of the finger nail each time the pulley revolves. By counting the revolutions in one quarter or one half of a minute, power roll speed may be calculated. Since the speed is slightly fast for ordinary counting, it is suggested that the count be run to ten and repeated. The tens can then be kept track of during the timing period.

The motor pulley is made in two parts to permit regulation of the power roll speed. Moving the outer section closer to the inner half will increase power roll speed. The inside half of the pulley should be set so as to lie in line with the idler pulley and prevent any tendency for the motor V belt to ride the edge of the idler and cause noise.

An adjustable motor drive pulley is provided on all Standard Electric Typewriters above approximate serial No. 39,500 and all Executive Electric Typewriters above approximate serial No. 10,400. This design facilitates the adjustment of power roll speed by providing a means of holding the pulley flange in position during adjustment.

The threaded pulley flanges are assembled and placed on the motor shaft in the manner shown in Figure 32 and locked in position with set-screws. A brass thrust shoe is provided under

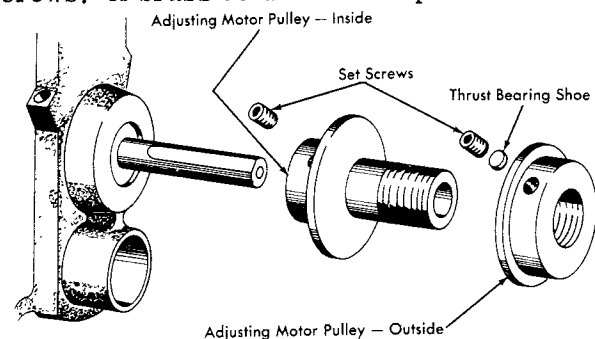


Figure 32. Adjustable Motor Pulley

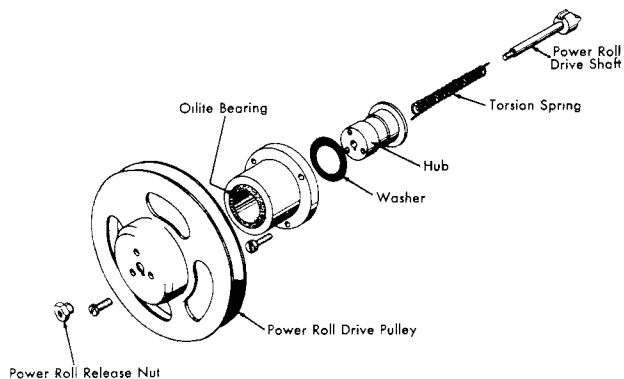


Figure 33. Power Roll Bearing Assembly

the setscrew in the outside flange section to prevent damage to the threads. This type of pulley is not intended to be used with DC governor-controlled motors because the increased diameter of the pulley hub prevents adequate power roll speed adjustment.

#### Belt Drive

The power roll is removed by first removing the ribbon lift operating link which lies under the center of the power roll. On Executive machines, the three interposer bell crank links must also be disconnected. By prying out on the release nut, the power roll will be free on the left end.

In replacing the power roll, observe that all surfaces are clean to prevent any noisy vibrations resulting from dirt. If the hex-head nut is removed while the power roll is removed, the torsion spring which serves to hold the power roll in will drive the left-hand shaft out of its bushing, necessitating extra work in its replacement. If it becomes necessary to replace the power roll shaft, the torsion spring should be wound approximately one turn before the insertion in its slot (Figure 33). Failure to wind the spring may result in a rattling sound.

#### Solid Shaft Power Roll

An improved design provides a more rigid mounting and reduces the possibility of operating noise. A solid shaft extends completely through the frame from the driven pulley, through the power roll and into the clutch disc (Figure 34).

Self-aligning bronze bearings for this shaft are placed in housings which are screwed to the side frames.

In order to remove the power roll, it is necessary first to remove the front case section. Next, remove the driven belt, the driven pulley,

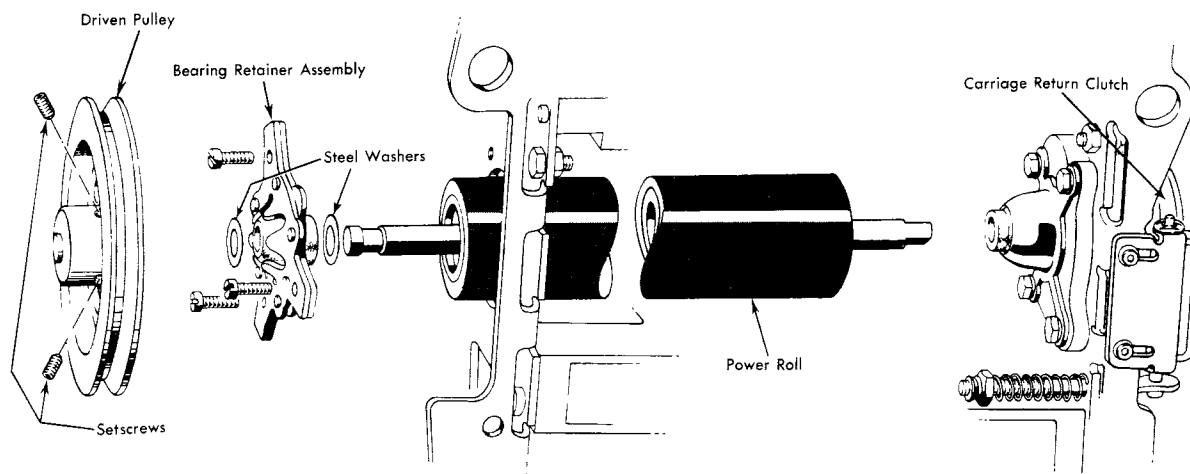


Figure 34. Solid Shaft Power Roll

and the three screws which hold the bearing housing to the left side frame. The power roll assembly may then be withdrawn through the hole in the left side frame.

The clutch should be placed in the latched position before the power roll is removed. This precaution will serve to hold the clutch parts in place when the shaft is removed, thereby facilitating reassembly. It will be noted that the right-hand end of the power roll shaft is chamfered for easy insertion into the clutch disc slot.

The power roll assembly, clutch disc, and clutch pulleys, are not interchangeable with former parts.

The driven pulley setscrews should hold the pulley on the shaft in such a position that the power roll will have a minimum of end play and should not permit the right-hand end of the shaft to interfere on the clutch plate bronze insert.

The tension of the V belts should be adjusted tightly enough to provide proper drive friction, but not so tight as to cause excess bearing wear or belt wear. If the idler pulley bracket is fastened to the side frame with screws, it should be adjusted to permit about 1/8" deflection of the V belts at the center of their spans. This can be checked by moving the belts up and down by hand, with the power off.

If the idler pulley bracket is suspended on a spring, and guided by studs through the side frame, then the motor should be moved to the rear as far as possible to prevent the idler pulley from striking on the cover. The same 1/8" deflection at the center of the belt span should be maintained.

The oilite bronze bearings should be lightly oiled with IBM No. 8 Lubricant on every inspection.

The oil should be applied carefully to prevent it from touching the rubber power roll.

Steel spacing washers, used to face the bronze bearings, should be assembled with the burr side facing away from the bearing so that the bronze will not be damaged.

### Key Levers

Key levers may be removed by first removing the spring from the front end of the key lever. Then, by releasing the key lever fulcrum rod at either end, the rod will be free and may be pushed along by a similar rod used as a follower. Maintaining slight pressure on the first rod, as the second one is tapped on the end, will prevent the first rod from bouncing away and becoming separated from the follower. By observing the movement of the key levers as the fulcrum rods travel through each lever, the proper place may be easily located. The fulcrum rods may then be separated enough to permit the desired key lever to drop down where it may be pushed to the rear sufficiently to clear the front guide comb and be lifted out.

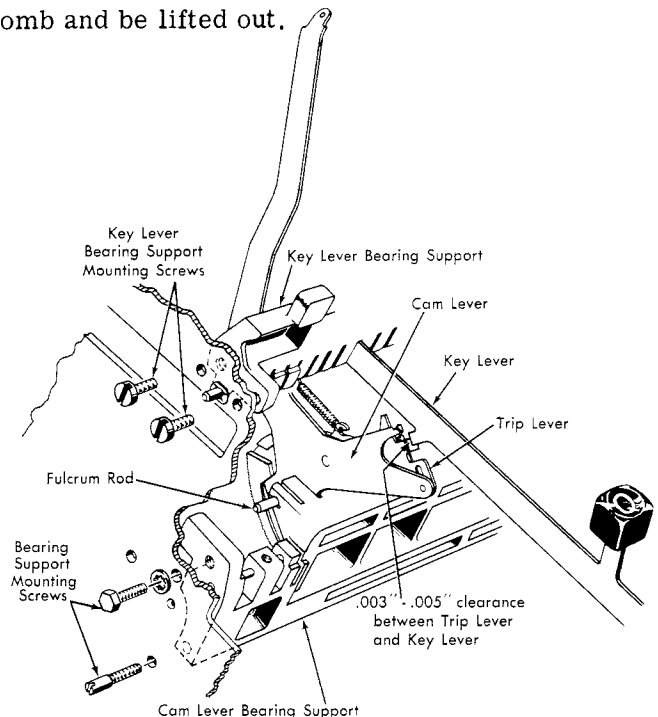


Figure 35. Cam and Key Lever Adjustment

Adjustment of the key lever bearing support should be made only after checking the cam clearance. Loosen the bearing support screws and adjust the bearing support up or down until the key levers trip their respective cams when the key lever is  $1/32$ ", plus or minus  $1/64$ " from the bottom of the key lever guide comb.

Test this adjustment by slowly depressing each key on the machine twice, with the power on. If any key fails to trip a cam the second time, examination will reveal that too little clearance exists between the key lever lug and the cam trip lever.

In the event that an individual key lever has too much or too little clearance with its appropriate cam trip lever, the key lever may be reformed by a sharp tap on top to close the clearance, or on the bottom to permit more clearance. The design of the key lever has been altered to include a U-shaped opening which may be spread open to raise the lug or closed to lower the lug (Figure 36).

After any treatment of the key lever, it should be examined, and formed if necessary to insure that the key lever lug is centered on the top of the trip lever. The trip lever has a specially formed top, or platform, which provides the maximum striking surface for the key lever lug.

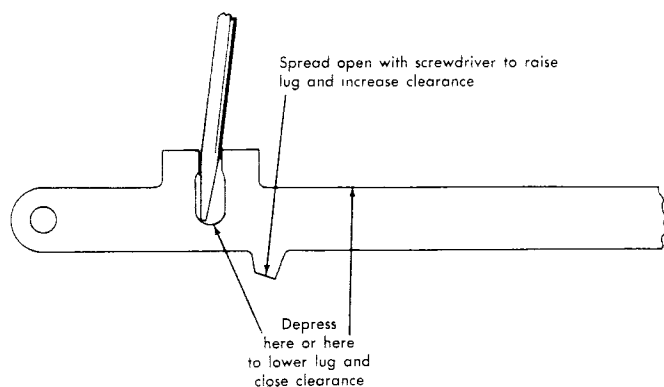


Figure 36. Adjustable Key Lever

Key lever tension is determined by the key lever tension springs installed on the front guide comb. Key lever tension is not adjustable and will be found to be 2 to 2-1/2 ounces for letter keys and 2-1/2 to 3 ounces for functional keys.

### Key Buttons

Key buttons may be carefully pried off from the key levers. Proper caution should be observed in attaching new buttons to get them on the same level with adjacent buttons, because any difference will be annoying to the operator and will probably contribute to errors in typing.

Key buttons are made of a substance which may be affected by alcohol; therefore any solution containing alcohol should not be used on the key buttons or similar plastic parts.

Adjust the key plate so that all key buttons will be perfectly free during operation. Adjust it to match the front case section. Be sure that key buttons are square in their holes.

### Line Lock

The line lock bracket should be adjusted so that the drag link contacts the margin stop extension  $1/32$ " before the tab lever hits the right hand margin stop, (Figure 37).

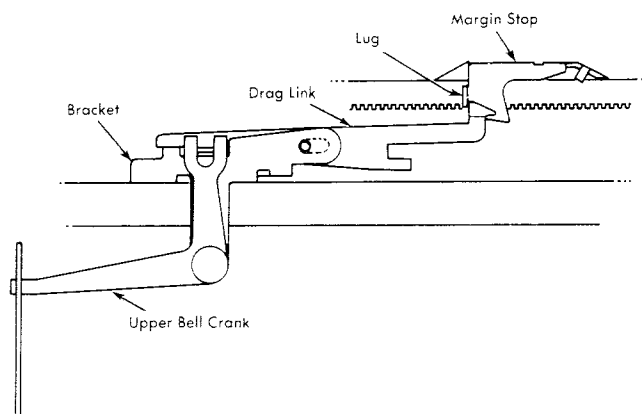


Figure 37. Line Lock Drag Link

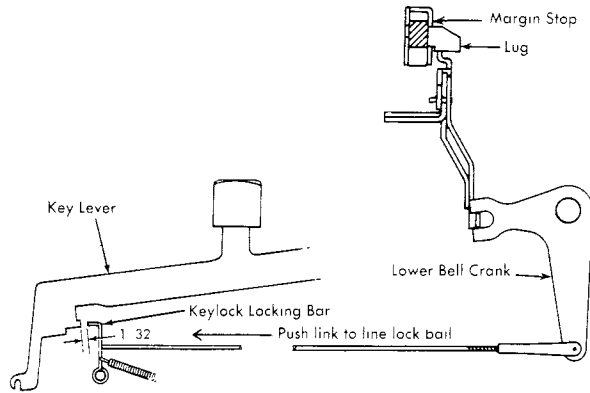


Figure 38. Line Lock Mechanism

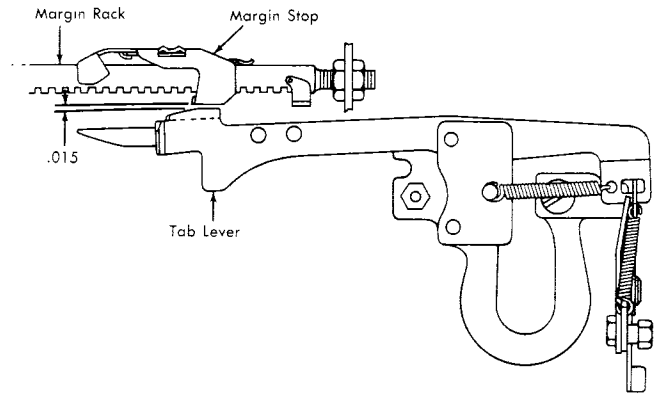


Figure 39. Margin Release

Hold the key lever down and position the carriage at the right hand margin. Push the link forward until the line lock bar touches the key levers and match the clevis pin to the hole in the bell crank.

### Margin Release

The margin release key lever link is to be adjusted as long as possible and still keep the bell crank from rubbing on the power roll. The adjustable clevis on the push rod should be adjusted so that the tab lever will just clear under the margin stops when the key lever is depressed to the bottom of the guide comb

slot (Figure 39). Care must be used in making this latter adjustment so as not to pull the push rod out of its guide hole.

### Margin Set

The margin set mechanism must be freed from all binds so as to recover properly after being operated. The lever must be adjusted so as to enter squarely into the notched top of the stop when the carriage is resting at the margin (Figure 40). The link must be adjusted to such a length that when the key is fully depressed, the stop clears the teeth of the margin stop rack

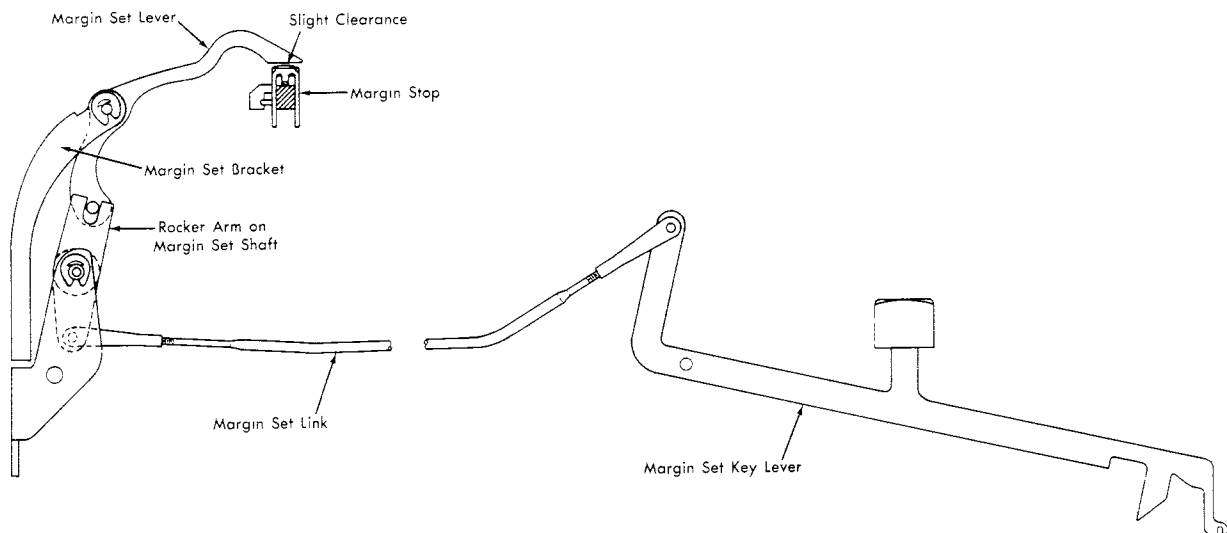


Figure 40. Margin Set Mechanism

sufficient to travel its full limit in either direction without drag or noise.

### Cam Lever Bearing Support

The cam lever bearing support serves also as a guide in keeping the letter cams in line so as to prevent their interfering with one another.

Removal of the cam lever bearing support may be accomplished by removing the impression control shaft and the cam knockout bar. The ribbon lift bail assembly must be free of its pivot studs but its links may remain connected. The functional cam stops should be removed or rotated out of the way. It will not be necessary to remove the power roll. Remove the fulcrum wires from the letter cams and from the operational cams. Allow the cams to rest on the power roll and remove the screws that hold the cam lever bearing support in the side frames. Remove the bearing support. Align the cams so that they are in line with their respective positions and install the replacement cam lever bearing support. Insert the fulcrum wire and pick up the cams one by one as the wire is pushed through the support.

Cam clearance will have to be checked and possibly readjusted, as well as the adjustment of the functional cam linkages.

### Cam Levers

To remove a cam lever assembly, first remove the power roll, loosen the screw that holds the clip in the right-hand end of the cam bearing fulcrum rod and insert another cam bearing fulcrum rod through either side frame as far as necessary to release the desired cam lever assembly. An opening in the rim of the power roll driven pulley has been designed to permit passage of the fulcrum rod.

Although it is not always necessary to remove the type bar from the desired cam lever first,

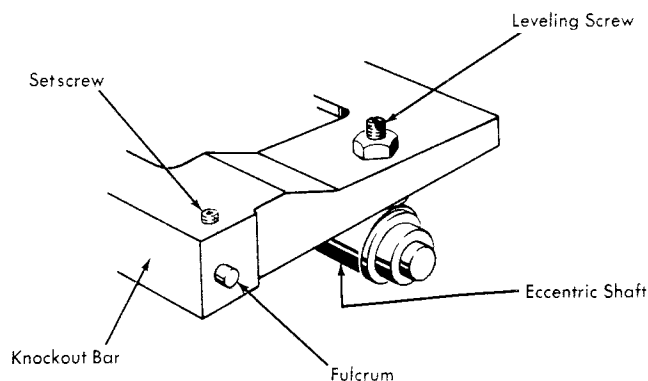


Figure 41. Cam Knockout Bar Leveling Screw

it will probably be easier, especially on the side bars, if the type bars are disconnected so as to free the tops of the cam levers.

An adjusting screw on the right-hand end of the cam knockout bar is provided for the purpose of leveling the knockout bar so that it rests evenly on both ends. The screw is not to be used to adjust impression because this would upset the level condition (Figure 41).

The operator may control typing impression by shifting the knockout point of the cams (Figure 42). The impression control lever, located under the left front side of the machine, rotates a shaft which operates eccentrically under the

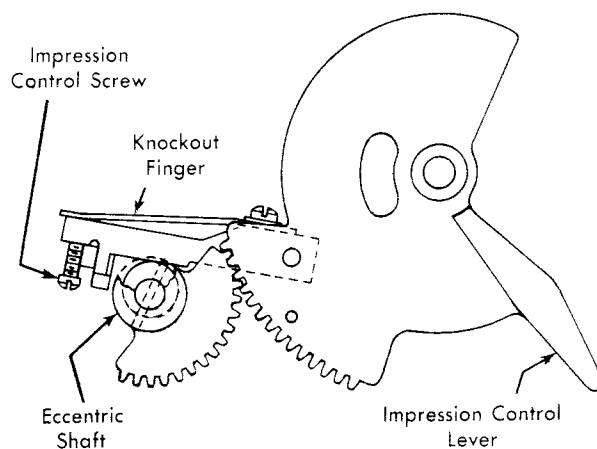


Figure 42. Impression Control Lever

cam knockout bar assembly. Moving the impression control lever toward the rear drops the knockout bar, delaying the knockout point of all letter cams to increase impression. Moving the impression control lever toward the front of the machine raises the knockout bar, causing all letter cams to knock out earlier, thus decreasing or reducing the impression of all type bars.

The cam knockout point may be controlled on individual cams: by turning the screws in on the knockout bar (Figure 42) to cause the cam to knockout earlier, and thus decrease impression; or outward, to delay the knockout point and thereby increase the impression of each type bar. It will be noted that the even-numbered type positions have been identified on the bottom of the knockout bar.

Adjustment of the impression control screws should be made with the impression control lever set on 5, when the scale reads 0 to 10, and on 2 when the scale reads 0 to 6. At the prescribed settings the screws should be adjusted to produce a satisfactory result on a single sheet of paper and on an original with two copies.

Clearance between the cams and the power roll is adjusted for all letter cams simultaneously by loosening the locking screws in the sides of the frame and moving the cam bearing support on its pivot studs until the cams clear the power roll by .015" to .020" (Figure 43). Observe that the clearance is within these limits for all

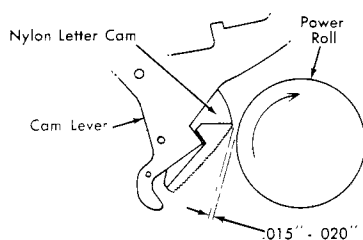


Figure 43. Cam Clearance Adjustment

cams. Use two tabulating cards as gages and insert the two thicknesses between the power roll and the cams. Let the cams rest on the cards, tighten the cam bearing screws, and pull the cards out. Be sure the cards will pass freely and that three cards will either not pass or will fit very tightly. This clearance may vary slightly across the power roll from one cam to another, but must be maintained within the limits prescribed. After any adjustment of cam clearance is made, the clearance between the cam trip levers and the key lever lugs must be checked, because it changes with any change in cam clearance.

Cam clearance is one of the most critical adjustments in the machine because of its great effect on uniformity of impression and keyboard function. If cam clearance is set too close, uneven impression will result, as well as cams "tying up" on the power roll, failing to knock out, and cams repeating because they lie so close as to be jarred against the power roll by their own rebound. On the other hand, if the cams are too far from the power roll, then the key levers may bottom in the front guide comb before the cams are moved far enough to contact the power roll. When cam clearance is correct and when the clearance between the key lever lugs and the cam trip levers is adjusted properly, the cam should trip when the key lever is depressed  $1/2$  to  $3/4$  of its total travel.

Cam clearance for the functional cams must be re-adjusted whenever the letter cam clearance is changed. The shift pusher link must also be re-adjusted whenever the shift cam clearance is adjusted. These adjustments are explained under their respective functional headings.

Occasionally, punctuation marks and similar light characters will strike hard enough to cause cutting or objectionable embossing of the paper any time that the impression control lever

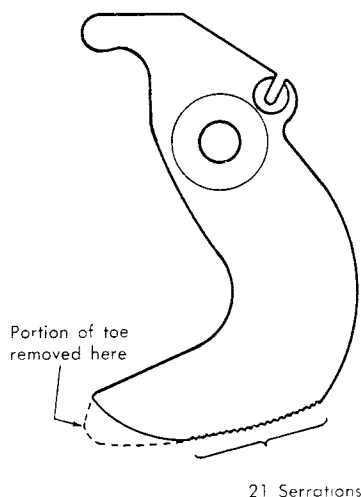


Figure 44. Cam Treatment to Prevent Embossing

is advanced to type extra copies. If it is required, for example, that the period be limited to an impression setting of no more than 4, while the best setting for typing several copies is 8, then the cam may be treated so that it will leave the power roll before being disengaged by the knockout finger (Figure 44). A grinding wheel, file or knife will serve to remove the unwanted portion of the cam.

Cams which "repeat" or deliver more than one operation for only one depression of the key, may be corrected by the following method: Increase cam clearance, remove about  $\frac{1}{8}$ " from the spring between the cam lever and the nylon cam so as to hold it tighter in rest position; clean the cam lever where the cam slides on its surface so that no oil remains to hold the cam against the power roll. Check to determine whether the cam rivet is too loose or too tight, as either condition could contribute to cause a repeating cam.

Replacement of defective nylon cams or defective cam trip levers may be accomplished by punching out the rivets which secure them to their cam levers. Rivets, nylon cams and trip levers are available for this purpose. Care must be used in riveting by hand so as not to create a bind.

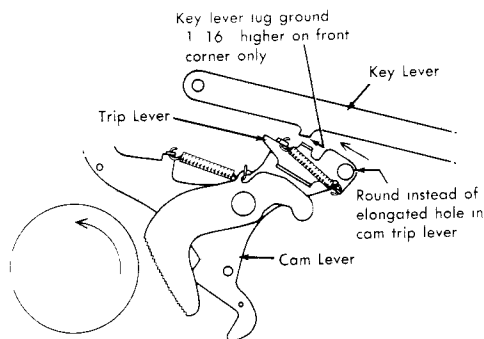


Figure 45. Repeating Cam

### Repeating Cams

In certain instances, a repeating cam may be desired on one or more of the type bars, such as the underscore. Figure 45 shows how a special key lever may be installed or, if necessary, may be ground in the field, so as to make the cam trip lever push the cam back into engagement with the power roll each time the cam lever restores to rest. Also illustrated is the specially designed cam trip lever which is mounted by a round hole instead of an elongated hole to prevent it from sliding forward when the cam trip lever strikes the key lever lug upon restoring. In the event that a cam trip lever with the round hole is not available, this feature may be improvised by shortening the cam trip lever spring to about half its length. This will effectively prevent the cam trip lever from sliding on the elongated hole when it contacts the key lever lug. Repeating cam trip levers should be carefully oiled during inspections.

### Type Bars

As the letter cam engages the power roll, the cam is thrown toward the front of the machine, causing the type bar to be pulled toward the platen. The type bar enters the type guide squarely and centered so as not to touch either side. The face of the type is curved to fit the curvature of the platen and is thus enabled to deliver a clear, even impression on the paper.

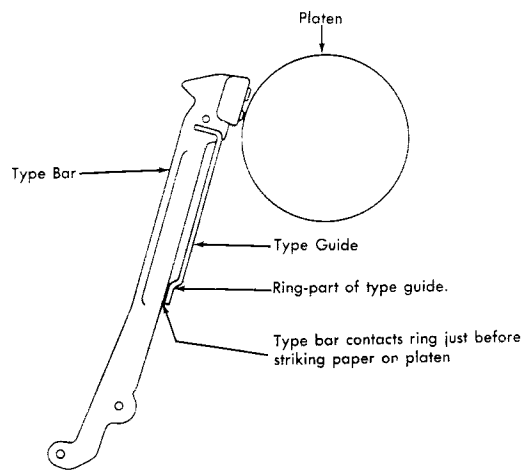


Figure 46. Type Bar Striking Ring, or Anvil

To insure a clean impression, the type bar is caused to strike the anvil or ring just before the type face strikes the paper, approximately .003". This "whipping" action prevents the type from lingering or smearing and helps to equalize the impression (Figure 46).

To remove a type bar, first loosen the segment wire retaining screws in the segment support at the ends of the segment fulcrum wire. Push the wire out with another wire until the desired type bar is reached. It will be noted that one end of every segment wire is tapered. It is best to place both tapered ends together when working to remove or replace type bars. The tapered end helps the wire to enter the fulcrum hole in the type bar.

In replacing the type bars, notice should be taken of the small mark on the upper edge of the type, located 5/8" out from the segment. By aligning these marks and by holding the type bar level with the other bars, the holes should be aligned.

#### Preparation for Type Alignment

Prior to undertaking the alignment of type, the condition of the typewriter for printing should be carefully checked. Power roll speed must be

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Figure 47. Type Alignment Strike-up

properly adjusted, according to the type face in the machine, against the table of speeds on page 35. The impression indicator should be set on 3 where the scale runs from 0 to 10. Where the scale runs from 0 to 6, the impression should be set at 2.

With the multiple copy lever set at zero, insert a single sheet of bond paper and make a test strike-up to determine the alignment of the type faces (Figure 47).

The shift mechanism must permit even printing of the top and bottom of all type. The shift motion must be correctly set so that the upper and lower case characters type on the same line as described on page 58.

The universal bar must permit all type bars to trip the escapement at an equal tripping point and the escapement mechanism must not bind off the action of the type. This adjustment is explained on page 54.

The ribbon lift bar must be free of binds.

A finer check on the alignment may be secured if the ribbon is removed or placed in stencil position, permitting the type face to strike directly on the paper. A slight indentation will be made in the paper which will usually show defects more clearly than the inked ribbon. Since this is more difficult to read, it is not always practicable.

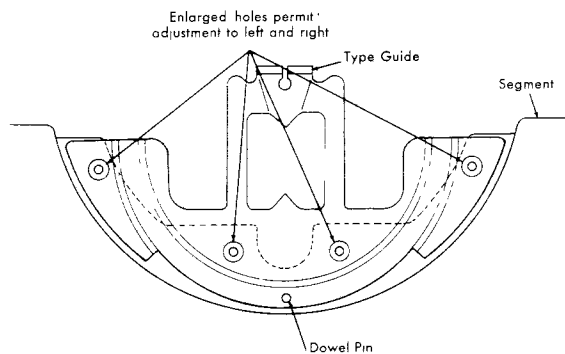


Figure 48. Type Guide Adjustment

### Type Guide

The type guide should be checked to see that it is properly centered. Strike up the keyboard against the N to test the location of the guide. Start with the No. 1 key (Q), No. 2 key (A), etc. on through the complete keyboard, using the N between each one. The following test result indicates a type guide that is too far to the right.

nqhanzwnsnxneendncarnnfhnvntngnbnynhnunjnmninknconlgn

This pattern shows that all of the left-hand bars are being pulled downward by the guide, while the right hand bars are being raised by it.

If the type guide is too far to the left, then the pattern appears as follows:

nananzwnsnxneendncarnnfhnvntngnbnynhnunjnmninknconlgn

With the guide centered accurately, the type will appear on an even line from left to right.

### Type Alignment

The type bars are aligned in relation to each other by using the N as a guide. The small n serves as a guide for the lower case letters and figures, while the large N is used to align capital and special characters above the numbers.



Figure 49. Checking the N

It is advisable to check the N before aligning other characters by it to insure that it is straight and that it enters the guide without touching the sides. It is suggested that the N be checked with the H, for example, NHNHN, before any changes are made in the alignment of the N bar. The N can also be checked by placing one capital N over the other, with no space between characters (Figure 49). This is done by indexing the platen by hand with the platen clutch released.

If the sides of the N's describe a straight vertical line parallel with the edge of the sheet, the N is straight.

There is no set procedure which must be followed in aligning type, because each type bar may need a slightly different adjustment. Until experience has been acquired, it is advisable to follow the procedure outlined here for the alignment of a single bar after installation.

1. Adjust the type bar for ring and cylinder.
2. Center the type bar in the type guide.
3. Twist the type so that it strikes evenly on both sides.
4. Center the lower case letters between lower case n's.
5. Center the capital letters between two capital N's.
6. Raise or lower the type to the writing line.
7. Cut the type only when necessary.

Each of these steps is explained in detail in the following paragraphs of corresponding number.

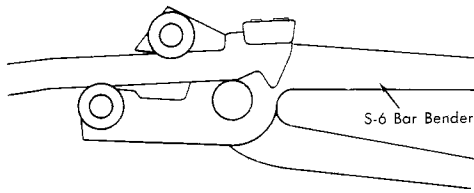


Figure 50. Bending Bar Toward Platen also Lowers Type Considerably

1. When a type bar is replaced, it should be aligned by first testing ring and cylinder adjustment. Place a piece of bond paper, about 1/2" wide and 4" long, between the type bar and ring. The paper should be gripped tightly when the type bar is held up to the platen with the thumb against the type bar at the ring. Place the paper between the ribbon and the paper on the platen, and holding the type bar as before, a noticeable drag should be felt as the test paper is withdrawn. If ring and cylinder are out of adjustment, correction may be obtained by using the S-6 bar bender in the following manner:

By placing a forward bend toward the platen, near the top of the bar, the type may be lowered considerably (Figure 50), and by placing a backward bend, away from the platen, near the top of the bar, the type may be raised slightly (Figure 51). In view of this characteristic, if no change in elevation is desired, it is advisable to keep the S-6 bar bender low on the type bar, when adjusting for ring and cylinder only.

A type bar may be shortened considerably, to secure a lower elevation, by placing two bends in the type bar with the S-6 bar bender. The

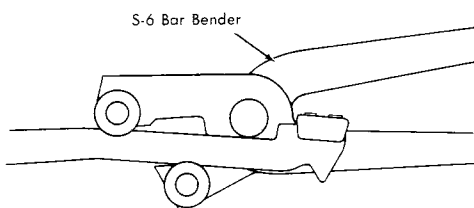


Figure 51. Bending Bar away from Platen also Raises Type Slightly

first bend should be low and backward, away from the platen, with the second bend high and forward, toward the platen, so as to regain the ring and cylinder adjustment.

After each adjustment of a type bar, ring and cylinder must be tested, and the type must be checked to see that it enters the guide freely and squarely. Also, a careful check should be made to see that the bar benders have not nicked the type bar so that it sticks in the segment. A file may be used to remove any such marks.

2. Center the type bar in the type guide by pushing the bar into the guide slowly with the finger tip near the bottom of the bar. A piece of white paper, placed behind the guide, but in front of the ribbon, will aid in observing how the type clears the guide. The type may be sent to the right or to the left (Figure 52) until it enters the guide perfectly. Three pronged pliers should be used for this purpose, but if these are not readily available, the correction may be made by holding the type bar near the bottom with a pair of pliers and, with a type aligning wrench, adjust the upper part of the type bar enough to align it with the guide.

Ordinarily the throat of the type bar will be straight and true so that the bar will respond to

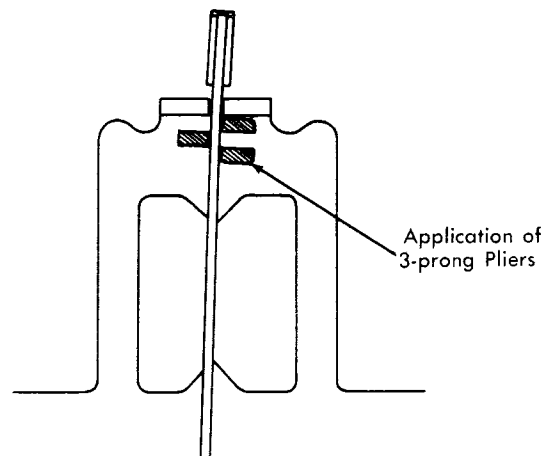


Figure 52. Type Bar Bent at the Throat

the three-pronged pliers. If the bar tends to stick in the guide, closer examination may reveal that the bar is bent at an angle (Figure 52). Application of the three-pronged bender just below the throat will straighten out the bar.

3. Twist the type on its feet so that it strikes evenly on both sides of the character. Catch the type bar at the throat with the narrow slot of one type wrench, then with the wide slot of the other wrench, twist the type head either to the right or left (Figure 53).

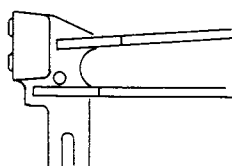


Figure 53. Application of Two Type Aligning Wrenches

4. The lower case letters should center between two lower case n's, nananan. If a type bar fails to center equally between two lower case n's, it may be necessary to use the knockover pliers and move the type to either the left or the right (Figure 54 and 55).

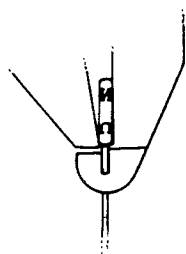


Figure 54.

Moving Type to Left

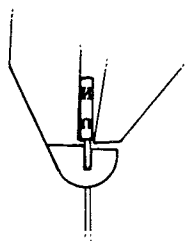


Figure 55.

Moving Type to Right

5. After using the knockover pliers, it is necessary to straighten the upper case character and observe that it is centered between two capital N's. For this purpose, place the type in the guide and pull the upper case type lightly to either side with an aligning wrench (Figure 56).

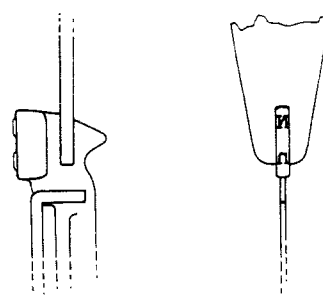


Figure 56. Moving Upper Case Type to Right or Left

6. To raise or lower type to the writing line, two methods are available. One method requires the use of the S-6 bar benders and was described in paragraph 1. The other method which employs the peening pliers, or maulers, is recommended when a minor adjustment is required in raising or lowering a type without changing its ring and cylinder adjustment. Place the tool on the edge of the bar and peen (Figure 57).

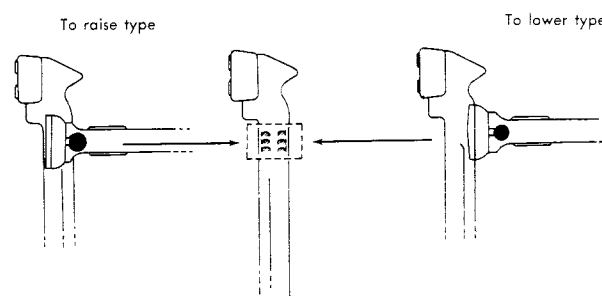


Figure 57. Peening Restricted to Area Indicated

There is a limit to the effectiveness of the peening pliers. Their use should be confined to three marks for either direction. The jaws should be adjusted, by means of the adjusting screw in one of the handles and by setting the jaws in the proper location, so that the points of the jaws lack  $1/64$ " of meeting when the pliers are closed.

If a type bar near either end of the basket prints too high, hold the type face up to the platen with the ribbon in stencil position. Observe the

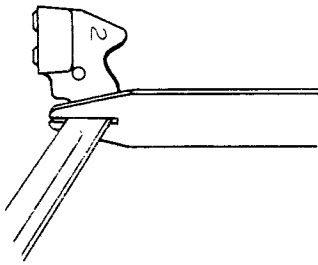


Figure 58. End Bar Alignment

amount of clearance between the platen and type face in both upper and lower case. If the upper case is more than the required .002" to .006" away from the platen, or possibly light on ring, place a type aligning wrench on the type bar (Figure 58) and twist the bar slightly so as to incline the upper case toward the platen. If the type is too low, the twist should be made in the opposite direction. Very often this is all the treatment required to bring a "Q" or an "A" into line, provided the bar enters the guide squarely afterward.

If it goes into the guide as illustrated in Figure 59, then place two aligning wrenches on the bar as indicated in Figure 60, and twist the head of the bar toward the right, still maintaining a firm hold on the top part of the type bar just below the throat. This treatment should raise the type face.

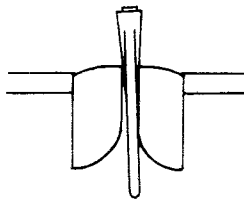


Figure 59. Type Bar Binding in Guide

7. When a type character appears to have correct ring and cylinder in both upper and lower case, but a part of the type face does not print, or prints lightly, then the type cutters should be used. Place the cutter jaws on the type head about 1/32" behind the face of the type and cut. The cutters should have been adjusted to prevent the jaws closing to less than 1/16".

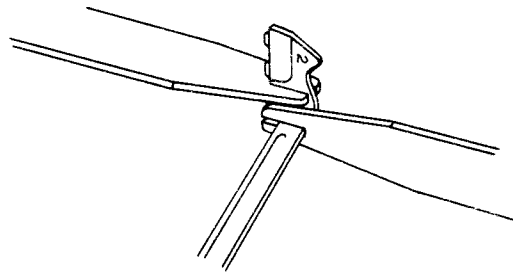


Figure 60. Correcting Guide Bind with Aligning Wrenches

### Type Soldering Fixture

A type soldering fixture (Figure 61) may be used to hold a type slug in place, or to guide it into proper position during re-soldering. It is not necessary to remove the type bar from the machine.

To raise the slug, place the guide on the type bar with its flat surface squarely against the face of the type and lock the screws tight. Heat the slug and carefully pry the slug upward the required amount with a screwdriver. To lower a slug use the same procedure but lock the fixture in place far enough below the slug to permit the slug to be pressed down, while hot, the required amount. To solder a slug on a new bar, install the bar and solder the slug in a trial position. Adjust the slug up or down by first adjusting the fixture. A slug may be tilted toward or away from the platen by first setting the fixture to the desired position and moving the slug to the fixture.

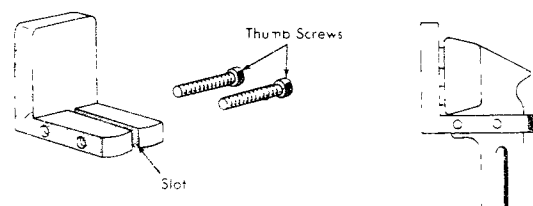


Figure 61. Type Soldering Fixture

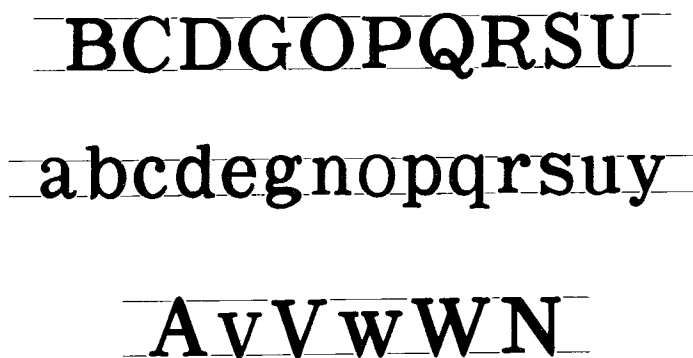


Figure 62. Round and Pointed Characters Extended beyond Guide Lines

### Type Design

In order better to judge type alignment, it is desirable to consider some of the details involved in creating new type faces. In the design of any type, general rules are followed to achieve an appearance of uniformity and to join a series of letters together so that they will not seem crowded or spread too far apart. The rounded shapes of some letters, for example, would tend to make the letters appear to occupy less space, and as a result, such letters would seem comparatively small. To overcome this illusion of smallness, the rounded portions of such letters have been designed to extend beyond their normal limits by approximately .002"

Pointed letter shapes have their points extended about .002" beyond the normal limits of the character in order to overcome an illusion of shortness which might otherwise exist. Such characters should be aligned by either the top or the bottom, whichever is opposite to the point (Figure 62).

The J is aligned by its top or serif and by the stem of the letter so as to be vertical (Figure 63).



Figure 63. Alignment of the Letter J

FLP

Figure 64. Letters Offset to the Right

Certain upper case characters are offset about 1-1/2 thousandths of an inch to the right (Figure 64).

This design tends to close the apparent gap between an upper case letter and the rest of the word in lower case (Figure 65).

For

Figure 65. Gap Closed by Offset Letters

Other letters will rest squarely on a common writing line and will be centrally aligned with respect to letter N in their own case, either upper or lower (Figure 66).

EHIKMTXZ  
hiklmxz

Figure 66. Letters Aligned Squarely

In the design of bold face types, the difference in heavy and light lines is derived from the pen lines of the original hand drawn characters (Figure 67).

ABCNXabcnx

Figure 67. Shading Combines Heavy and Light Lines

In this illustration, it may be noted that the sides of the N are light while the diagonal is bold. Other letters should be studied carefully for this characteristic before an attempt is made to align them.

The type illustrated here has been drawn from the pattern of IBM Proportional Bold Face type to demonstrate the principles of type design.

The primary purpose of alignment is the overall appearance of the typed page, to which the alignment of each letter can contribute. For this reason it is advisable to use the following test combinations which portray the various letter combinations in their most common forms.

AMARANTH SASSESUSOS SECEDES INITIAL  
 amaranth sasesusos secedes initial  
 ORONOCO URUGUAY  
 oronoco uruguay

#### Impression Control Adjustment

The tendency in adjusting impression control screws is to use them too frequently when a correction in the alignment of a type bar is clearly indicated. All of the requirements of good alignment, as outlined under the standard machine adjustments, are essential to proper control of type impression.

A tendency also exists to set the impression too light by means of the impression control screws, thus inviting occasional light or faded characters. As soon as these major tendencies are overcome, even impression is comparatively easy to achieve and maintain.

A number of factors influence impression, and these factors must be studied and understood thoroughly in order to apply them properly to the control of impression.

The motor is capable of delivering steady, uniform power as long as the bearings are free and well lubricated. Motor failure would become apparent in carriage return failure before it would affect type impression. Low voltage can contribute to uneven impression and should not be disregarded.

The power roll cover must be tight, must run true and concentric, and the surface must be clean and free from greasy or oily substance. The power roll bearings must be clean, free and well lubricated. Type impression would be impaired if any of these items were overlooked.

The knockout bar is designed with a screw and lock nut on the right-hand end for the purpose of leveling the bar so that it rests with equal pressure on both sides. The leveling screw should not be used to adjust impression because such practice would affect only the right side of the machine and would introduce noise during typing, caused by the bar resting above the impression control shaft on one side. The bar would then make noise by striking the shaft each time a cam struck the bar.

The knockout fingers perform their function normally without lubrication, but if it is felt that an advantage may be gained by lubricating the fingers, a thin application of Aeroshell No. 7 may be used. The necessary precautions must be taken to insure that none can get on the power roll. This lubrication is recommended especially for the modified cam knockout fingers.

Cam levers must be perfectly free. Any indication of binding would appear on individual type impressions rather than to affect the general appearance of all type. Hold the universal bar toward the rear and move the type bar by hand to check for binds. The cam lever bearing support should help guide the cam lever and

insure that the cam levers cannot tilt. Indications of wear on the sides of the cam trip lever springs would be indications of wear in the cam lever bearing slots sufficient to allow interference between cam lever assemblies.

Clearance between the cams and power roll should be adjusted to .015" to .020".

The cam lever guide comb should permit perfect freedom of cam lever travel without any binding. Lubrication is important and should consist of applying Aeroshell No. 7 in such a manner that the slots are well lubricated. Oil cannot be used here, because it will travel directly down to the power roll and cause slip-page and light impression.

The links between the cam levers and the type bars must lie in place so that they can be freely moved from side to side in their connecting holes. Testing the links in this manner will indicate the absence of binds. Operating the type bars by hand will show any interference between links that may be present. The cam levers should be so formed that no interference exists.

The type bar segment slots must be kept free from binds. Precautions should be taken, in clearing a bind from one segment slot, to insure that adjacent slots are not closed so as to cause a bind. One means of clearing a bind is to hold the bar firmly against one side, and then the other of the segment slot and move it back and forth between the type guide and the type rest. Check the adjacent bars after this treatment. An effective cleaning tool for removing dirt from segment slots may be made from a discarded type bar by grinding a hook on the bottom end.

The type guide must be open enough to permit free passage of all type bars. During the testing of this feature, if most bars pass and only

a few seem to stick, the difficulty can be overcome by straightening the type bars, rather than to try to open the type guide. Rarely, the type guide may appear to be magnetized or a type bar may apparently be magnetized. This condition, if it is suspected, may be verified by suspending a steel object in the proximity of the affected part. The magnetism, if present, will draw the steel article to the part. Use an article that has no magnetism of its own.

Upper and lower case characters should balance in density of impression. To achieve this result, the upper case has been adjusted to "shift off" cylinder about .002" to .006" more than the lower case. If upper case characters appear too dark, then the upper case is too heavy on cylinder. Correction may be made by adding one or two .010" thick shim washers under the front end of each upper segment guide spring, or basket spring. Installation should be made one at a time so as not to disturb the general position of the type basket. The basket must be allowed to hold its own position while the screws are being tightened.

Occasionally a machine may be found on which the lower case is too heavy on the cylinder. Removing shims from under the front end of each upper segment guide spring will cause the lower case to lighten with regard to the upper case. Installing shim washers under the rear ends of the same springs would have the same effect.

On Executive machines it will also be necessary to check the selecting mechanism completely to insure that none of the parts can cause a type bar to choke off and print lightly.

The escapement mechanism, universal bar, escapement triplink and escapement pawl assembly must be carefully checked for binds which might reflect in poor type impression. This

check should include bars on the left, center and right.

If a type bar shows light and dark impression for no apparent reason, remove the bar and examine it at the point where the universal bar meets the type bar. If there appears to be a worn spot where the universal bar could bind the type, stone off the edges of the spot so as to permit smooth operation.

The ribbon operating bail vane should be lubricated with Aeroshell No. 7. The factory lubrication is adequate to take care of this item; so it should not interfere with type impression by loading the cam lever operation. The ribbon lift connecting link, under the power roll, should not cause trouble on type impression, except if the link is adjusted so long that the toggle linkage in the ribbon lift mechanism cannot take care of the motion and stops the link. This stoppage would be reflected in the cam lever motion and would cause light impression on stencils.

The platen is one of the greatest single factors in determining type impression. If the platen is hard, the type impression will be less clear at the edges, will have a softer outline and will not have the tendency to cut. The applications being performed on the machine must dictate whether a harder or softer platen is required on a given machine. Never leave a machine with the impression set so light that the impression will fail a short time later. Always leave the impression set strong enough to insure that it will print dark and clear.

The carriage must be adjusted in three ways to insure uniform type impression. First, the carriage rails must hold the carriage from side play, but without binding. Second, the carriage reinforcing plates must hold the platen from shifting back and forth. Either of these two items, if defective will cause the type im-

pression to appear uneven by allowing the platen to rock back and forth. For example, if the platen rocks back, the type impression appears low and light. If the platen rocks forward, type impression appears high and heavy. If impression appears uneven but not above or below the line, then the trouble cannot be traced to these items. Third, the platen guide eccentric shaft supports on the ends of the carriage must be set so that ring and cylinder is correct and equal on both ends of the platen.

The platen guide arm, or multiple copy lever, must be set to the proper position for the work done. The operator should be instructed to use this lever in the following manner: Set the lever generally at zero; when the number of copies is increased to a point where some capital letters appear blurred or fuzzy, then move the arm back, one number at a time, until these letters print clearly and all other type are satisfactory.

The ribbon feed cam should have the non-repeat lug removed, otherwise it is possible for this item to cause intermittent light impressions.

Finger prints, although not always visible, can contribute to poor impression by rendering paper surface repellent to the impression of carbon paper ribbon. This difficulty would show up as irregular, spotty sections of poor type impressions.

Paper, ribbons and carbon paper are discussed in other sections of this manual and should be thoroughly studied as an aid in preventing or correcting impression difficulties.

After having checked all of the conditions mentioned, the impression control screws should be adjusted so as to provide a strong dark impression without cutting through the paper or the carbon ribbon when it is used. In deciding where to set the screw when it is difficult to secure



Keyboard Chart

both of these conditions, it is best to leave the screw set slightly heavy.

When the machine is equipped with the flat knockout spring fingers, one half turn of the impression control screws will alter the knock-out point of the cam by an average of  $1/8$ ", measured at the type face.

If the machine is equipped with the modified cam knockout, the difference will be an average of  $3/16$ " per one half turn. Therefore, it is advisable to determine what type of knockout is installed in any machine requiring impression adjustment. The difference indicated would be noticeable in typing.

A special kind of strike-up will prove helpful in making an accurate and uniform impression adjustment.

#### Keyboard Chart

Place one original and two carbons in the machine and type a strike-up of the keyboard in the sequence indicated in the Keyboard Chart.

QA@ZWS#XED\$CRF%VTGçBYH&NUJ\*MIK(,OL  
,P: \_ ? !"  
qa2zws3xed4ccrf5vtg6byh7nuj8mik9,ol0.p;-/1'

Remove the form from the machine and tip the machine up on its back. Referring to the back of the original for excessive embossing and to the face of the original for light impression, nearly all of the impression control screws can be adjusted properly the first time across. Using this strike-up places the typed impressions in the same numerical order as the numbers on the knock-out bar.

A repeating cam will sometimes deliver a heavy character on its first stroke and the balance of line will be lighter. This is traceable to rebounding of the type bar as it restores to the type rest. A special type bar rest pad assembly (Figure 68) is available and may be easily installed to take care of this trouble. This principle is now built into machines as the result of an altered segment support design.

The proper platen for each application is a prerequisite to good impression. Information on platens and their uses may be found on page 24, and on applications, page 158.

#### Overprinting and Underprinting

Overprinting is caused by the upper case characters striking the paper when writing in the lower case. This causes a mark to appear

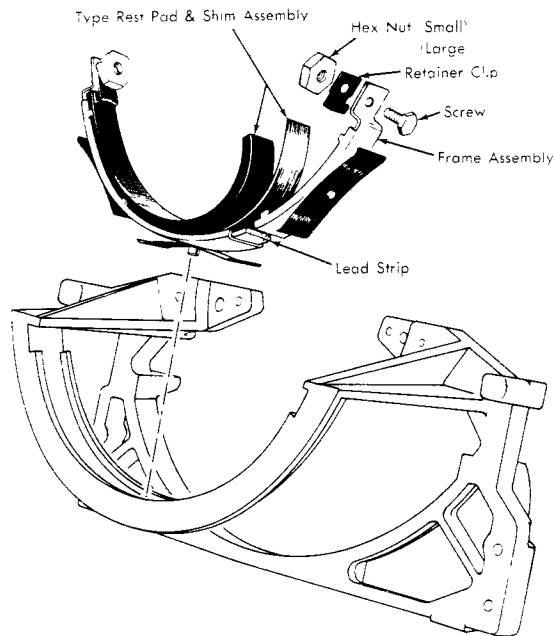


Figure 68. Special Type Bar Rest Pad

over the small case characters. Underprinting is caused by the lower case characters striking the paper when writing in the upper case, causing a mark to appear under the capital letters.

The following will help to eliminate this condition:

Check the ring and cylinder adjustment, making sure the type bars strike the ring .002" to .006" before they strike the paper on the platen. A test should show a moderate drag on a piece of onionskin paper inserted between the ribbon and the paper with the type bar held at the ring.

Adjust the basket so the type print evenly on the top and bottom of the characters. If overprinting still results adjust the basket slightly higher. If correcting for underprinting only, adjust the basket slightly lower.

Check the motion of the basket shift.

If underprinting occurs when typing a multi-

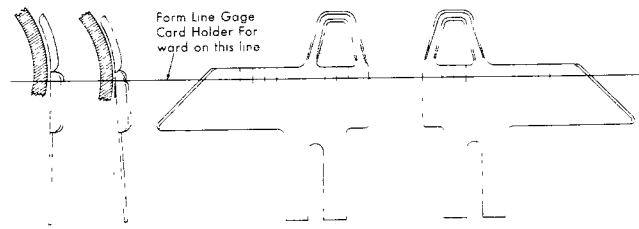


Figure 69. Forming of Line Gage Card Holder

copy form, it can be reduced or eliminated by the use of an undersize platen.

Form the card holder to keep the paper against the platen as closely as possible without causing the carbon paper to mark the copy sheet (Figure 69).

### Escapement

The escapement pawl bracket assembly may be removed from the rear rail by first removing the two screws that retain the clutch knockout lever and by disconnecting the triplink and spring. As soon as the escapement pawl is removed from the rack, the main spring will pull the carriage hard to the left; so it is advisable to block the carriage with a tool of some sort first.

On machines where the rear rail has no dowel pins to locate the escapement pawl bracket assembly, the bracket should be mounted to the rail and held as far to the left as possible while the screws are tightened. This precaution will preclude the possibility of the escapement pawl bracket shifting so as to invite back space failure on heavy carriage applications.

The universal bar may be removed, through the bottom of the machine, by first removing the ribbon lift mechanism from the bottom center of the power frame. Disconnect the trip link and spring and remove the screws that hold the front universal bar spring to the segment.

Removal of the universal bar should not be required except in cases where the type and segment may be replaced, or in the event that the universal bar should be found defective. In the latter case, a test should be made of the new universal bar after installation to insure that the spring tension of the flat springs on the universal bar does not overcome the type bar action to the extent of causing light impression.

Spring tension is measured by attaching a spring scale to the universal bar at first one extremity and then the other of the rear flat spring. Attachment may be made by means of a wire led in through the rear frame so as to provide a direct pull to the rear with no snubbing or binding of the wire.

With a light pull toward the rear, rapidly move a type bar in and out of the type guide. Slowly increase the pull on the scale and watch the scale indicator move up and down the scale in time with the type bar movement. As the pull on the scale is increased, a point will be reached where the movement of the scale indicator will cease. This is the point where the scale spring and the universal bar spring are matched in tension.

This point should be reached at a reading of from 1 lb. to 1-1/4 lbs. Greater tension can contribute to light impression; less tension can contribute to type piling by failure to restore the universal bar to rest position in time to clear one escapement operation before the next one is required.

The correction for too strong tension is somewhat difficult to achieve because it requires that the top ends of the universal bar be brought slightly closer together. One method has been recommended which may be used with caution, and good results may be expected. Remove the front dust cover and place a screwdriver on the center of the universal bar just behind the seg-

ment. A light tap on the screwdriver should cause sufficient change in the contour of the universal bar that a lighter spring tension will result.

In the event that the spring tension is too light, the only means of increasing it would be to form the ends of the universal bar at the points where the flat springs are riveted, so as to effectively tighten the springs. This method could result in difficulty in the form of broken springs, loose rivets and fractured universal bars. Therefore, it is recommended that a universal bar with weak spring tension be replaced.

If the carriage and rails have been previously removed, then the universal bar may be taken out through the top of the machine. The ribbon center guide must also be disconnected in either case. The universal bar should be installed so as to rest as high as possible without binding against the segment. It may be adjusted so that all type bars trip the escapement pawl at an equal tripping point. The left side of the universal bar should rest a few thousandths away from the segment, while the right side should rest on the segment. This condition may be obtained by placing three type bars up to the guide simultaneously so that they bind each other in position with No. 1 bar leading toward the platen by 1/8". The No. 22 bar should rest beside the No. 1 bar and should be 1/8" farther from the platen than the No. 1 bar. Follow this by placing the No. 42 bar beside the No. 22 bar but lagging away from the platen by 1/8" from the No. 22 bar (Figure 70).

With the universal bar held in this position, loosen the hex-head stud that holds the rear flat spring to the bracket so as to permit the universal bar to be held against the three type bars (Figure 70). This will insure that the right side of the universal bar will be struck slightly

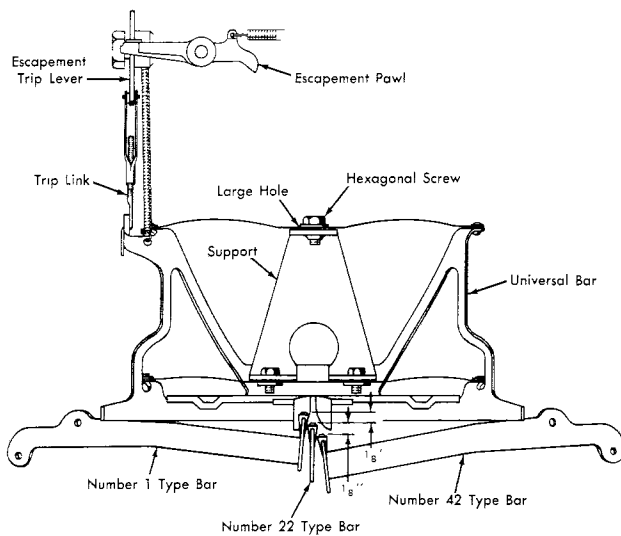


Figure 70. Adjusting the Universal Bar to Produce an Even Tripping Point

earlier than the left during operation, so as to compensate for the amount of yield that is inherent in the universal bar design. Tighten the hex-head stud to retain the bar in this position. Test the tripping point with type bars numbered 1, 22 and 42 to determine that they all trip the escapement at an equal distance from the platen.

After the universal bar has been properly set, the trip link must be adjusted so as to trip the escapement pawl out of the rack when any type face is  $\frac{3}{8}$ ", plus or minus  $\frac{1}{16}$ " from the platen. The tripping point should again be tested with type bars numbered 1, 22 and 42.

If the type bars trip earlier or later in the upper case than in the lower, it may be necessary to form the lug on the universal bar that carries the elongated hole where the trip link is attached. This is an adjustment which is seldom required and must be made with great care so as not to change the form of the universal bar spring or to loosen rivets. If the upper case type trips earlier, form the lug downward and vice versa. The trip lug is annealed to permit reforming.

The type segment may be removed by first removing the platen, deflector, the dust cover from the front rail, and the center ribbon guide. The type bar segment wire should be removed, permitting the type bars to drop out of their slots and rest below the segment. By disconnecting the trip link and spring and removing the segment screws, the segment and universal bar may then be removed through the front of the segment support. The carriage should rest to the extreme left to facilitate the removal.

Main spring tension should be adjusted by placing the loop of the tension tape on the proper lug of the main spring drum, until the tension of the carriage is just sufficient to trip the tabular mechanism with the last tab stop. The carriage should be positioned at the last tab stop before latching the tab lever to avoid the braking influence of the tab governor. If the tab lever should be latched out while the carriage is further back and the carriage travelled up to the last stop, the effect of the tab governor would be felt, and an erroneous reading would result, causing the adjuster to set the main spring too tight. Carriage tension may be measured, by pulling the carriage with a spring scale at a slow and steady rate from extreme left to extreme right. The tension should read as follows:

12" carriage	2 lbs. at start, 2-1/2 lbs. maximum
16" carriage	2 lbs. at start, 2-3/4 lbs. maximum
20" carriage	2 lbs. at start, 3 lbs. maximum
24" carriage	2 lbs. at start, 3-1/4 lbs. maximum
30" carriage	2 lbs. at start, 3-1/4 lbs. maximum

The main spring may be removed by removing the main spring drum support stud. The carriage tension tape should first be disconnected from the main spring drum. Care must be exercised in permitting the main spring to run down. By holding the friction governor plate tightly against the drum, the speed of its action may be controlled sufficiently to prevent injury or damage.

It will be noted that the main spring has its outer spring turn placed outside one of the retaining lugs of the holder so as to provide a more even tension throughout the main spring operation.

The escapement rack is screwed and doweled to the bottom of the carriage frame, and no difficulty should be encountered in its removal. After disconnecting the tension tape from the right-hand end of the escapement rack and fastening it to any convenient part of the machine so as not to lose the main spring adjustment, the screws may be removed from the carriage frame and the rack may be pried downward. This will permit its removal without removing the carriage from the machine. Escapement racks may be exchanged on standard carriages, but on Executive machines the close tolerances required will not ordinarily permit such replacement.

The number of teeth per inch in the escapement rack determines the pitch of the machine, such as 6-2/5, 8, 9, 10 (Pica), 12 (Elite), 14 and 16. One standard escapement pawl assembly will serve with an escapement rack of any pitch.

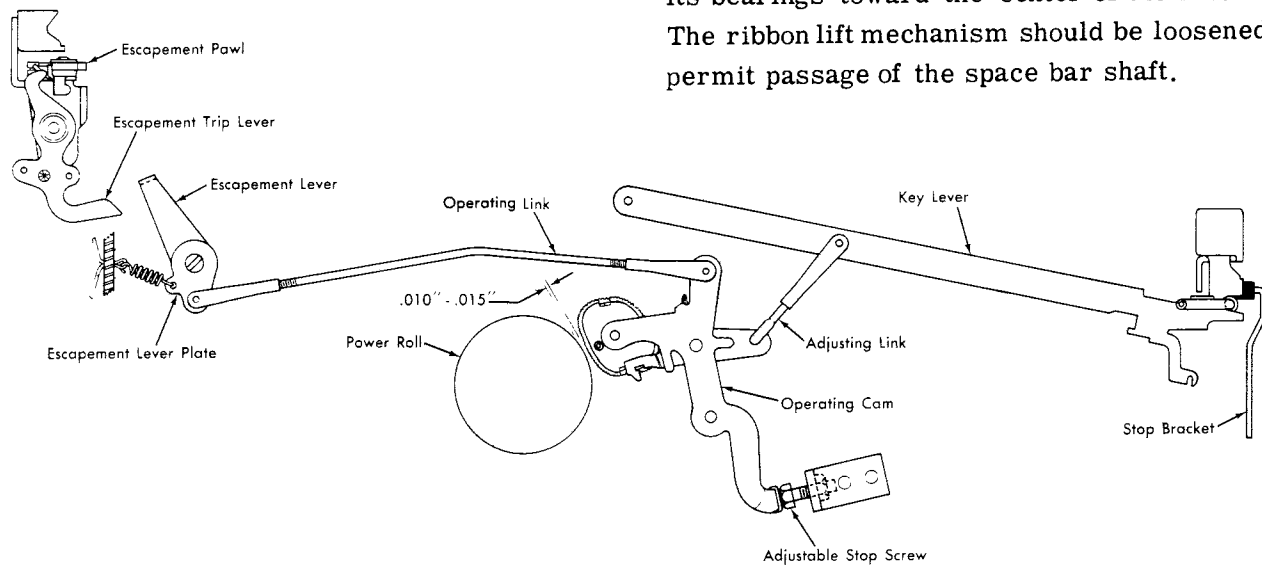


Figure 71. Space Bar Mechanism

## Space Bar

The space bar may be removed by first removing the space bar bail and unscrewing the bar from its supports.

The space bar key lever may be removed by first removing the front section of the frame which is held by two hexagonal-head screws on each side of the machine. Pushing the key lever fulcrum wire out with another fulcrum wire will release the key lever which may then be pulled out through the key lever guide comb.

Removal of the space bar cam may be accomplished by loosening the setscrews on top of the left end of the cam bearing support and pulling the short cam bearing rod which will release the space bar cam. The cam knockout bar should be removed to permit the functional cams to be removed after their links are disconnected.

The escapement lever assembly may be removed by removing the idler pulley. Unfasten the space bar link, unhook the spring, and remove the screw that holds the lever arm on the left of the escapement lever shaft. Remove the shaft from its bearings toward the center of the machine. The ribbon lift mechanism should be loosened to permit passage of the space bar shaft.

The link from the key lever to the cam should be adjusted to trip the cam when the key lever has reached  $1/2$  to  $3/4$  of its total travel. The cam should restore when the key lever is two-thirds returned. Observe that both lugs of the cam release lever are able to clear the cam lugs in turn. If difficulty is experienced in securing this adjustment, the space bar bail stop may require shifting up or down.

The cam should be adjusted, by means of its stop screw, until the cam clears the power roll by .010" to .015". Observe that the cam trips sufficiently, with the power off, to permit the non-repeat lug on the release lever just to clear the back of the cam lug.

The operating link (Figure 71) is to be set by means of the adjustable link on the front, or cam end, so that when operated by hand, the escapement trips just before the cam reaches its highest point. Test to see that the mechanism does not choke off by noting that the cam may still be moved a small distance away from the power roll after the cam has reached its highest point.

In order that the proper spring tension be applied it is necessary that the cotter pin "eye" be against the power frame (Figure 72). When the cotter pin is not assembled in this manner, sufficient spring tension might be lost to allow cam slippage.

Replacement springs are available with a hook on one end which eliminates the need for the cotter pin.

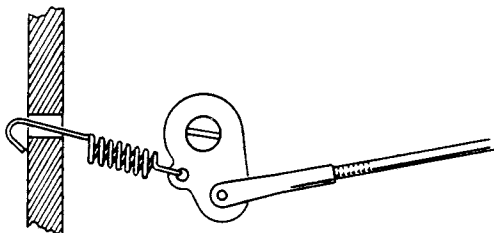


Figure 72. Escapement Lever Spring

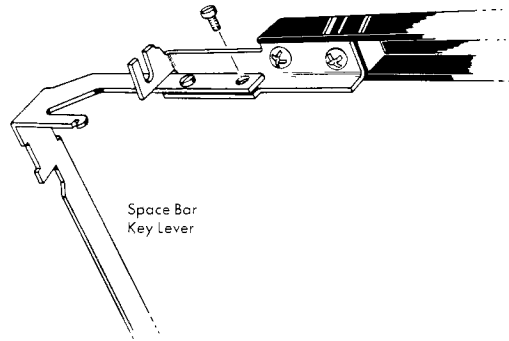


Figure 73. Space Bar Bracket Adjustment

The space bar key lever is provided with elongated holes for mounting the left-hand space bar bracket (Figure 73). This feature allows sufficient adjustment in the space bar position to prevent interference or binding against the key plate.

#### Shift Mechanism

Removal of the shift pusher assembly may be made by first removing the pusher link (Figure 74), the auxiliary hairpin spring and the retainer. Disconnect the operating link and remove the screw that holds the upper end of the actuating lever.

The segment support carries a spring mounted type rest which absorbs the shock of type bars restoring to rest and effectively overcomes the tendency for type bars to rebound (Figures 68 and 74). It is essential that the form and curvature of the type rest be maintained uniform and that the type rest should touch on the supporting springs at both ends.

To remove the shift toggle lever assembly, follow the same procedure as outlined above, except that the actuating lever mounting screw may be left assembled to the power frame. Remove the right-hand toggle torsion spring, or hairpin spring. Remove the horseshoe clip that holds the stud in the toggle link bracket and remove the stud. Drive the tapered pin out of

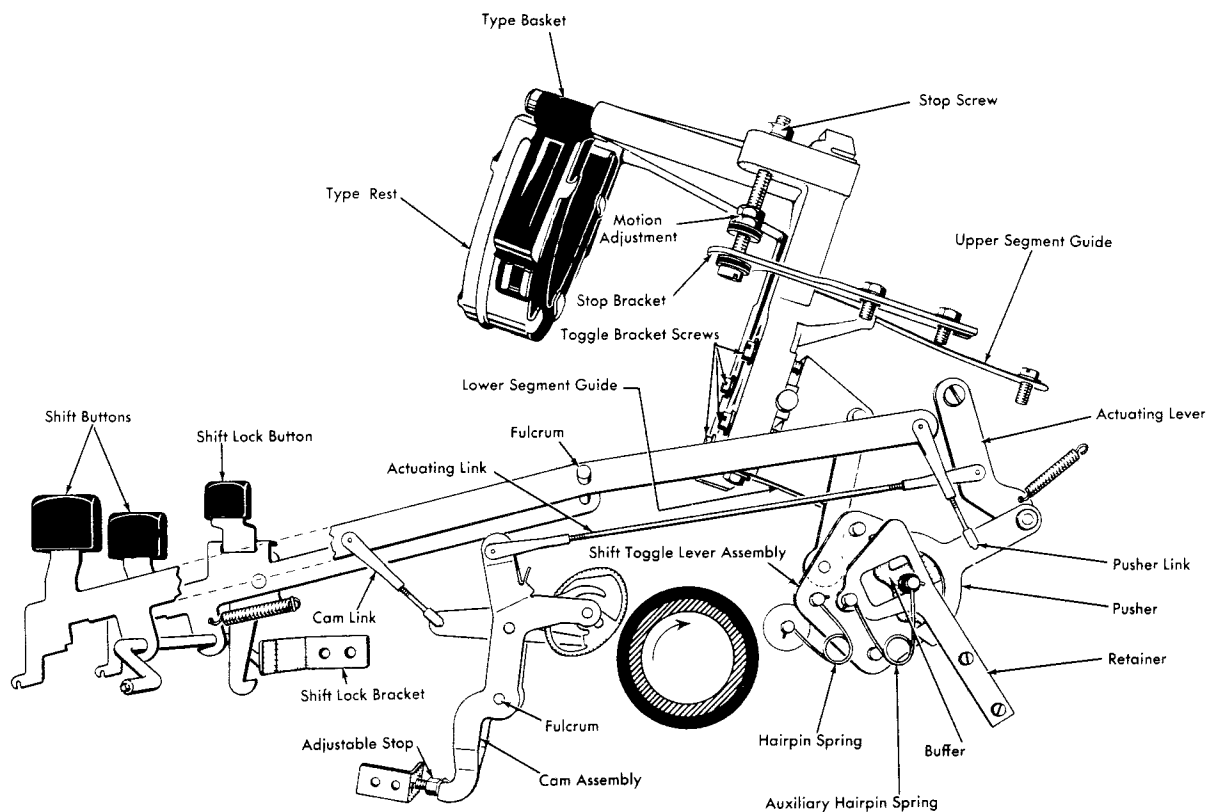


Figure 74. Shift Mechanism

the hub of the toggle lever assembly and remove the assembly from the shaft.

To remove the lower segment guides (flat springs) it is necessary to remove the lower rear screws. The lower front screws need only to be loosened, since the front ends of the flat springs are open.

Adjustment of the shift mechanism cannot be properly made without first setting ring and cylinder, because the platen could be too far to the rear (off cylinder), and the type impression would look heavy on top. By a similar error the platen could be too far to the front (off ring), and the type impression would look heavy on the bottom. The multiple copy lever should be in the zero position when checking the shift with one sheet of paper.

After ring and cylinder adjustment has been properly made, the shift stop screws should be adjusted so that the type impressions will appear even on top and bottom, and the segment support will rest evenly on both the right-hand and left-hand stop washers. This adjustment should be gaged principally by the lower case characters.

Adjust the locking nuts on the stop screws so that the upper case characters will print on the same line as the lower case. This is an exacting adjustment which is called adjusting the motion. Check the stop washers to be sure that the segment support rests evenly on both the right-hand and the left-hand sides.

Adjust the cam so that when the cam is released with the power off the release lever lug will drop behind the cam lug by an amount equal to the thickness of the release lever.

Adjust the link brackets, by means of their screws, until the clearance between the pusher lever and either pin on the toggle lever assembly is equal, without regard for the actual amount of clearance. For example, in order to increase clearance between the pusher and the upper pin, loosen the two upper bracket screws and tighten the two lower bracket screws an equal number of times. This will decrease the lower pin clearance.

Recheck the motion after any change in pin clearance and observe that equal pressure exists at all four of the shift stop washers. Two pieces of paper, used as feeler gages simultaneously, one under each stop, may be used to determine equal pressure. Both sides should be exerting equal pressure to avoid unequal strain on either side and to insure positive shift action.

Adjust the cam release lever link so that it will trip the cam when the key is depressed  $1/2$  to  $3/4$  of its total travel.

Adjust the shift pusher link to such a length that the upper edge of the upper pusher arm will be in line with the top of the upper pin of the shift toggle lever assembly at the instant the cam trips.

Adjust the shift operating link so that the pusher clears the pins by  $1/32$ ". Clearance is related to the power roll speed because of the action of the buffer. It may be necessary to increase pin clearance to as much as  $1/16$ " so that there will be no hesitation in the movement of the segment support to its stops, especially if power roll speed is decreased materially. The light auxiliary torsion spring helps to position the buffer when it is shifted.

In the event that the segment support tends to bind after adjustment of the link brackets, remove the two heavy torsion springs from the left and right ends of the shift toggle levers

assembly, loosen both of the screws on either right-hand or left-hand link bracket so as to permit the segment support to float on its flat springs or segment guides. The segment support should float freely about  $1/16$ " below a point half way between the upper and lower shift stops. If the support is lower than the prescribed position, remove one of the upper segment guides or flat springs and re-form it upward so that it supports the segment support higher. Duplicate the operation on the other segment support guide until the proper position is attained. At no time should more than one of the segment support guides be removed. When the guides are replaced they should be permitted to lie in position while the screws are tightened so that the normal position of the segment support will not be disturbed.

Any shim washers which may be present under the segment guides should be carefully replaced unless it is desired to change the characteristic of shifting off cylinder in the upper case. The amount of shifting off cylinder may be controlled

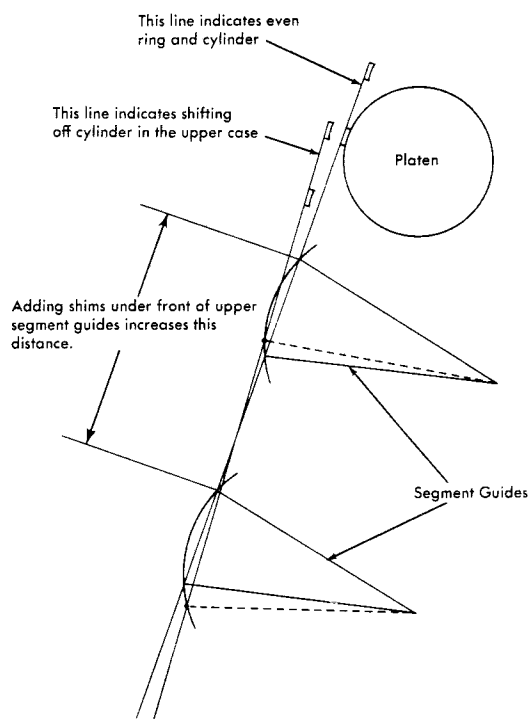


Figure 75. Adjustment for Shifting off Cylinder in the Upper Case.

by changing the total thickness of the shims used (Figure 75).

Each shim washer, .010" thick, placed under the front end of each upper segment guide, will cause the upper case to shift off cylinder approximately .003". Shim washers, removed from under the rear ends of the upper segment guides, if any are present, would give a similar result. The application of this treatment would be required if upper case characters appeared too dark and fuzzy by comparison with the lower case. Shim washers added under the rear ends of the upper segment guides would give the opposite effect and would cause the upper case to be heavier on cylinder.

If the basket does not vibrate when struck, with the left and right torsion springs removed, then the shift toggle bracket screws are not properly balanced in adjustment. Determine that pin clearance is equal for both the upper and lower pins and loosen both screws on one toggle bracket. The basket should vibrate freely when struck. Turn the toggle bracket screws, which were loosened, slowly and when it is felt that the screws begin to tighten, work from one screw to the other and test the basket for vibration at each step. In this manner the toggle bracket screws may be tightened, the pin clearance may be maintained equal, and the basket will shift with a quick, free movement.

### Carriage and Rails

The carriage trucks may be removed by the following procedure.

Loosen the rear rail adjusting screws (one on each end).

Remove the two rear rail clamp screws.

Remove two screws from the rail supports.

These screws are accessible from underneath the typewriter. There are two screws holding each rail support, one with the eccentric nut should not be loosened or removed.

Move the carriage to the extreme left and remove the rear and front trucks. Move the carriage to the extreme right and remove the remaining trucks.

In order to have the star wheel properly engage the racks of both the rails and the carriage ways, the star wheel must be vertical. To meet this condition, the truck must be inserted the same way that it was removed. Observe that the recesses for the rollers are larger at the top and smaller at the bottom, thereby preventing the rollers from dropping through the trucks.

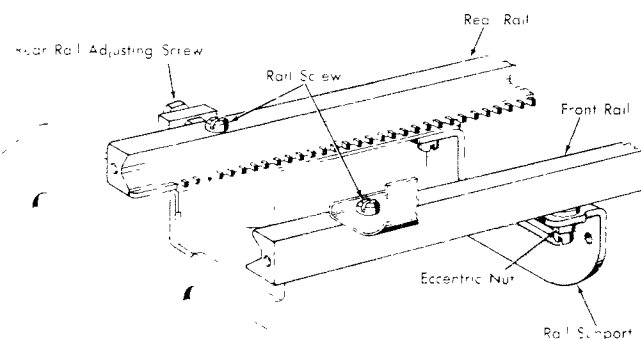


Figure 76. Rail Adjustments

Trucks are equipped with star wheels carrying ten teeth which engage the milled teeth in the racks to keep the trucks from running out either end of the rails. If the racks are not recessed (Figure 77, c), then the nine-toothed star wheel should be used, since the ten-toothed wheel might bind in such a rack.

Trucks should be assembled in the rails so as to be flush with the carriage ends at either extreme of carriage travel, plus or minus two teeth. The number of trucks required depends on the length of the carriage:

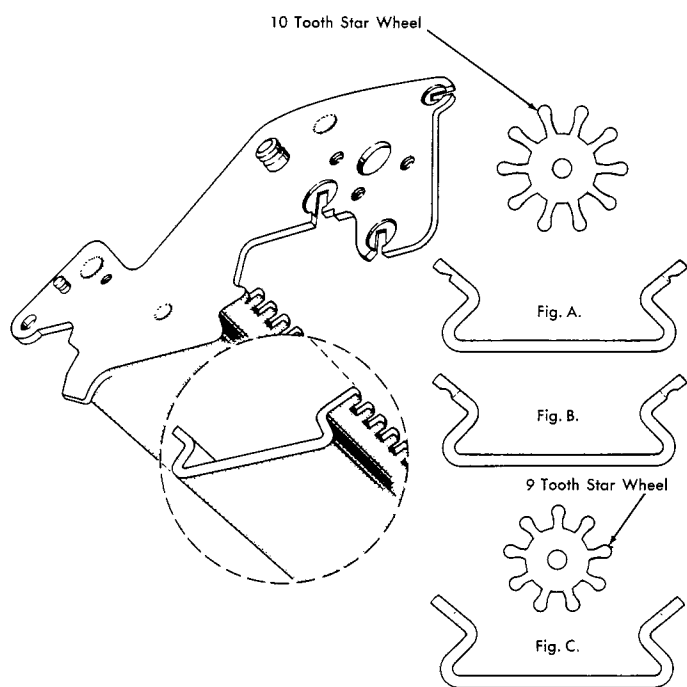


Figure 77. Carriage Truck Star Wheels

12" carriage requires	4
16" carriage requires	6
20" carriage requires	8
24" carriage requires	10
30" carriage requires	12

The rails are to be adjusted by positioning the front rail tightly against the power frame and tightening the front rail screws. The carriage should then be placed so that trucks are positioned in line with the left-hand rail screws. With the rear rail screws loose and with the rail support eccentric adjustment loose, press the rear rail forward tightly by hand and drive the rear rail screw down tight. Repeat this operation on the right-hand side and test the carriage fit for free travel without side play. Secure the adjusting screws against the rail and adjust the rail support eccentrics, so that the carriage will be free to travel, without side play, from one extreme to the other. Carriage rails longer than 16" will have end brackets which must be adjusted in the same manner.

Removal of the rails may be accomplished after disconnecting the tab governor link, tab operating link, escapement trip link and spring, the back space operating link from the cam to the bell crank and the clutch linkage. After disconnecting the carriage tapes and removing the margin set assembly from the rear frame, the rail screws may be removed and the carriage and rail assembly may be lifted out of the machine. By securing a one-inch length of scotch tape to the link clevis where it attaches to the link, the adjustment of any link may be maintained during disassembly.

In the case of the Executive typewriter the procedure is nearly the same, except that the following steps must be added. Remove the three interposer bell crank links and their springs. Remove the interposer bell crank guide comb and disconnect the expander link. During this type of disassembly, the rail supports can maintain their adjustment so that when the assembly is re-installed, adjustment of the carriage fit will be comparatively simple.

The Executive carriage is mounted on  $1/32$ " shims to raise the writing line of the platen up to the writing line of the type faces. Executive type slugs are soldered  $1/32$ " higher on the type bars so as to permit them to fan out better and eliminate interference.

#### Paper Feed

To remove the platen, first place the line space lever to the extreme rear in order to raise line space parts out of the way. Release the upper carriage end covers and swing them back on their hinges. Center the carriage and spring the right-hand platen latch forward just far enough to permit lifting the platen out of its yoke. Repeat this process for the left-hand side and shift the platen slightly to the right to avoid the line space parts. Before replacing the platen,

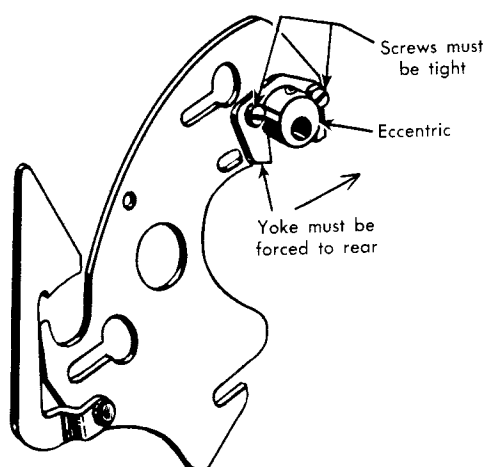


Figure 78. Reinforcing Plates.

try the bushings to insure that they are free and well lubricated. Any excessive end play should be removed from the right-hand bushing by placing a series of center punch marks on the shoulder of the end plug, where it lies next to the bushing. This will reduce any tendency for the platen to shift to the right.

Reinforcing plates, attached to the platen guide plates, serve to hold the platen guide eccentric bushings more stable. Adjustment of these small plates should not be necessary unless the mounting screws become loose (Figure 78). Loose screws will usually be evidenced by type impressions appearing high and heavy, alternating irregularly with an appearance of the same type being low and light due to the platen shifting back and forth from front to rear.

If the screws are found to be loose, or if there is play between the reinforcing plate and its eccentric, then, while the plate is held tightly by means of the carriage reinforcing plate tool (Figure 79), the screws should be well tightened. The tool should be hooked on to the paper bail spacers and pressure applied downward. This will draw the platen guide plate back while pushing forward on the reinforcing plate so as to remove play between the platen guide plate and the eccentrics.

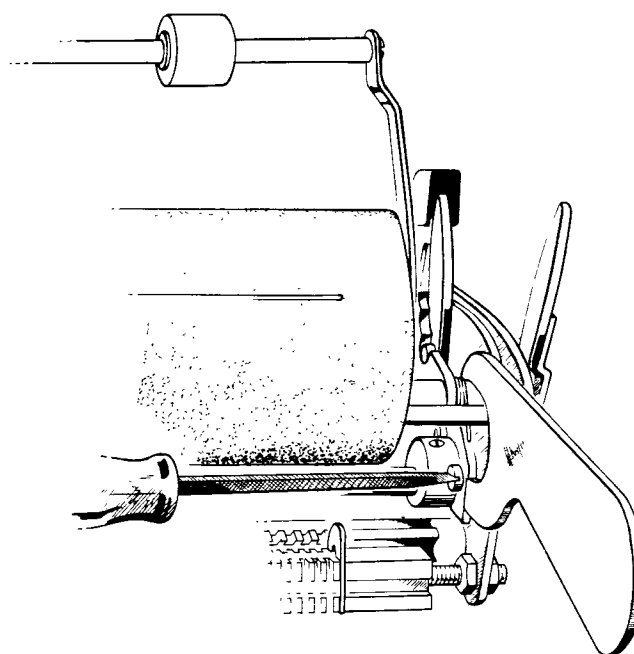


Figure 79. Reinforcing Plate Tool

To prevent the platen shifting to the side and causing paper slippage on former model machines, a .040" washer may be placed between the platenguide plate and the end frame so as to be held in place by the right-hand front carriage end cover screw. Current machines are equipped with the spacing studs.

To remove the deflector and feed roll assembly, simply lift the assembly upward off the equalizing shaft (Figure 80). Feed rolls may be removed from the deflector assembly by loosening the locking nut on the feed roll pivot screw and turning the screw out of the deflector yoke. Upon replacing the feed rolls, all end play must be removed by adjusting the pivot screws. However, the feed rolls must be free to spin. Grease should be used as a lubricant, because oil would travel and destroy the rubber.

Feed roll pressure is adjusted by means of pressure springs and adjusting screws located in the bottom of the carriage under the feed roll lift arm. Feed roll pressure is measured by inserting a one-inch wide paper strip between a

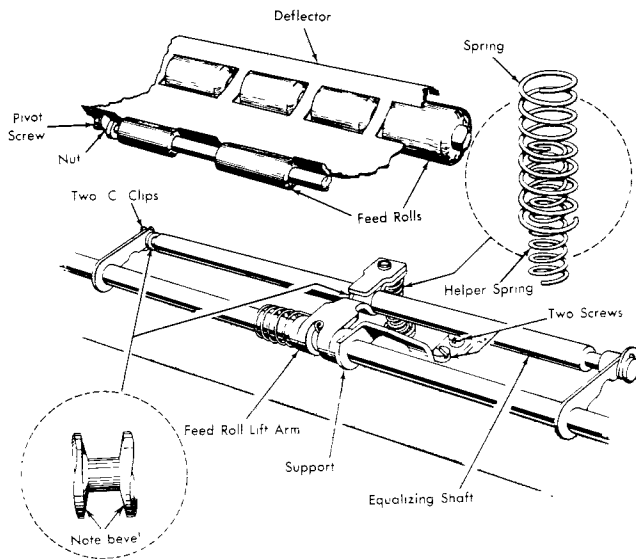


Figure 80. Feed Roll Support Assembly

rear feed roll and the platen to a distance of two-tooth feed for a standard or coarse tooth ratchet, or three-tooth feed for a fine tooth ratchet. At the factory a tension scale is attached to a test strip of .010" fish paper to measure the tension required to withdraw the test strip over the extended bail shaft. The tension required to withdraw the strip should be 1-7/8 to 3 pounds with 1/4 pound variation from side to side. Measure the outer, rear rolls of each deflector.

To prevent paper slippage, all side movement of paper feed parts must be held to an absolute minimum. Beveled grooves in the center and in one end of the equalizing shaft serve this purpose. A feed roll lift arm with maximum contact on the actuating shaft and made for a snug fit on the shaft will also minimize side play of feed rolls. Installation of a helper spring, inside the standard feed roll pressure spring, will increase pressure and assist in overcoming paper slippage. The helper spring is wound in the opposite spiral to the standard pressure spring so that the two springs will not become intertwined. When the helper spring is installed, paper release will be difficult unless

a support is installed beside each lift arm to brace the actuating shaft and prevent it from bowing.

The feed roll release mechanism should permit the easy straightening of a pack of paper equivalent to an original and ten carbon copies, with the feed roll release lever and the multiple copy control lever in their forward position.

If difficulty is experienced in trying to shift paper with the release lever forward, examine the feed rolls and determine whether the front feed rolls interfere on the paper while the rear feed rolls clear properly. This would indicate that the tilting backward of the deflector should be corrected.

Attach one loop of a key lever spring, 1072126, to each front feed roll pivot screw, run the spring around the actuating shaft and hook the other end of the spring in the same manner. Type bar springs, 1090341, may also be used by cutting them down to approximately 11/16" including the end loops.

It may be necessary on some applications to undercut the front feed roll if it interferes with the front scale collar.

A small angular plate with two holes may be attached on top of the actuating shaft support in such a manner that the upright section of the plate will catch and support the deflector when the paper release lever is operated. The plate will support the rear feed rolls and will thus move the front feed rolls away from the platen.

To remove the platen ratchet, first unscrew the platen variable button from the left-hand platen knob, using a platen variable button tool (Figure 81).

The tool is the same item as the ITR master

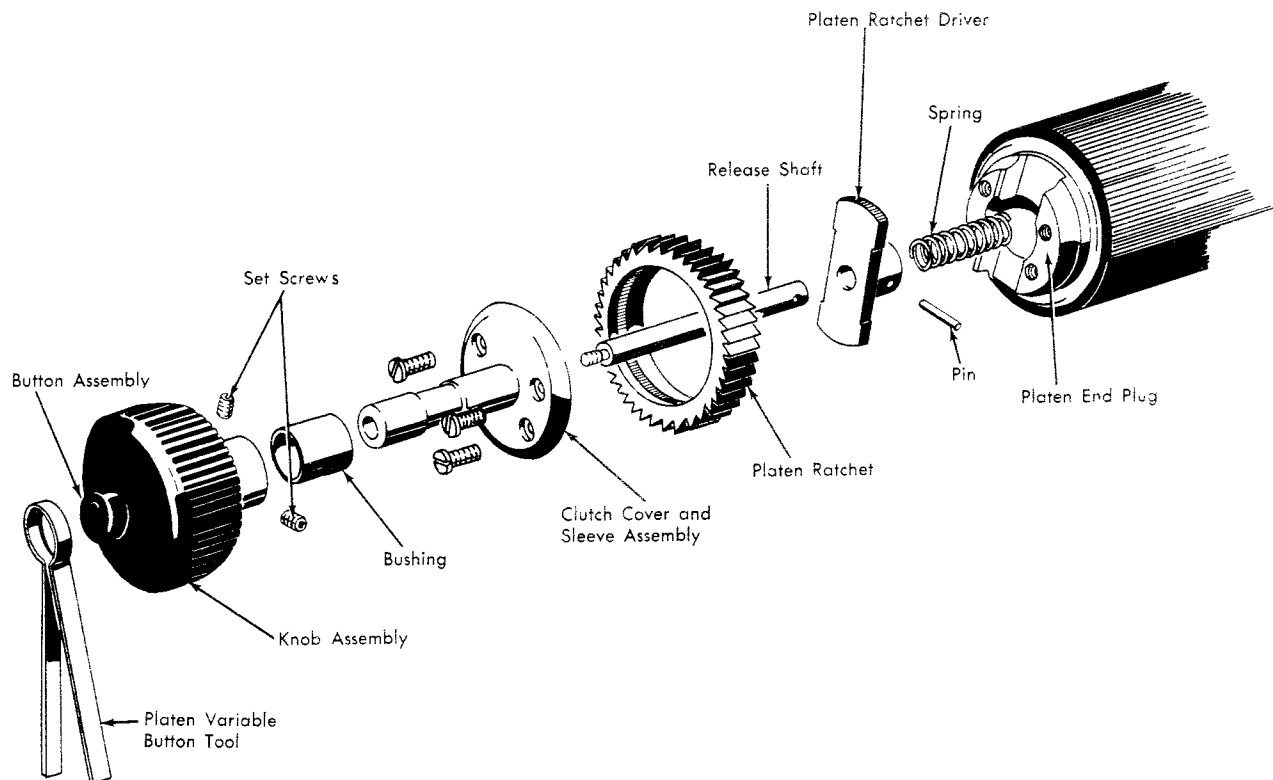


Figure 81. Platen Ratchet

clock winding key and consists of a nearly closed loop of narrow steel band with two equal ends about 2-1/2" long. The platen knob may then be removed by loosening the setscrews which secure it to the shaft. This will permit access to four screws which hold the platen clutch cover and sleeve assembly. Removal of this assembly permits the ratchet to be removed.

To remove the platen guide plates, it is necessary to remove the bail springs, the platen guide eccentric screws and the platen adjusting shaft.

Adjust the platen for ring and cylinder by placing the multiple copy lever or platen guide arm (Figure 82) toward the front of the machine and, with a sheet of paper in place, adjust the eccentric nuts on the rear corners of the carriage until the platen has equal and correct ring and cylinder adjustment on both ends of carriage travel. To test for ring and cylinder,

place a piece of bond paper, about 1/2" wide and 4" long, between the type bar and the ring. The paper should be gripped tightly when a type bar is held up to the platen with the thumb against the

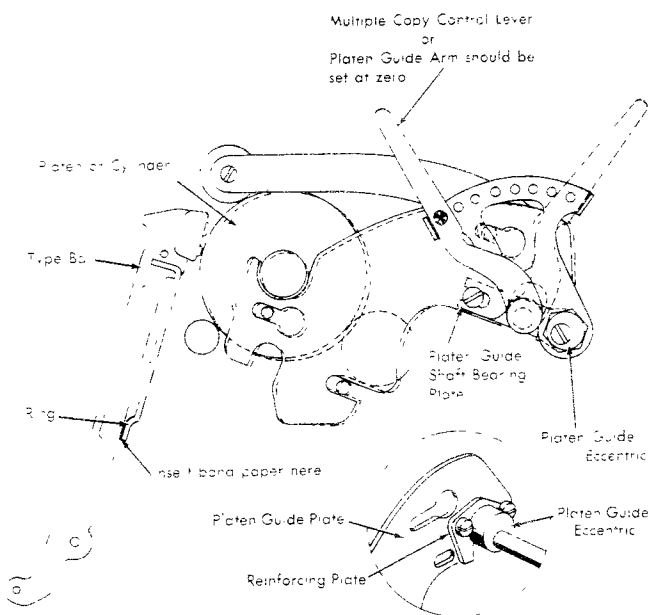


Figure 82. Ring and Cylinder Adjustment

type bar at the ring. Place the paper between the ribbon and the paper on the platen, and, holding the type bar as before, a noticeable drag should be felt as the test paper is withdrawn. Repeat this test at both ends of the platen, using the same type bar each time. An even finer check for ring and cylinder may be made by repeated typing of periods at each end of the platen with the impression set light. The amount of embossing on the back of the paper will indicate any differences.

Wrinkling trouble can be traced to unequal feed roll pressure, feed roll pressure too heavy, misalignment of feed rolls and platen or the limp qualities of some papers or stencils. The following procedure will help overcome such difficulties:

Remove the platen and feed rolls. Remove the springs under the actuating arms. Check the actuating shaft to be sure that it is not bowed. If a bow is observed in the shaft, loosen the center support screws and allow the actuating shaft to be restored to its normal straight position, and tighten the center support screws. Replace the springs beneath the actuating arms, replace the deflectors and platen, and check the paper clearance. Straightening the actuating shaft allows the feed rolls to assume a parallel position with the platen.

Form the rolled edge on the deflectors as illustrated in Figure 83. The normal clearance between the platen and the curled lip on the deflector is approximately .100". This clear-

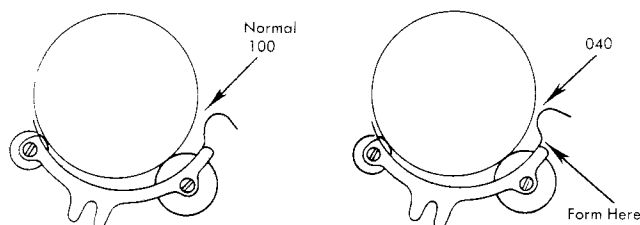


Figure 83. Forming Feed Roll Deflectors

ance should be reduced to about .040" by forming. This forming will tend to iron out the wrinkles before the paper enters the feed rolls.

The forming operation may be more easily accomplished if a fulcrum rod is temporarily inserted in the formed lip along the back of the deflector. This will provide a means of gripping the rolled edge with a pair of pliers to push it forward.

After the deflectors are formed (Figure 83), the paper table should be raised sufficiently to conform, approximately 3/16" to 1/4". The last two steps will remove air from between the sheets as the copy is fed into the machine.

If the foregoing steps do not correct the wrinkling and slippage, the following procedure should be used:

Check the feed roll pressure and reduce it as low as possible.

Hold down the feed roll lift arms and see if they can be moved to the right or left. This side play can cause wrinkling as well as paper slippage.

In the case of a long carriage machine, disconnect the equalizing arms from the equalizing shafts and replace the deflectors and platen. Rotate the platen forward and backward and watch the deflectors carefully while so doing to see if they move to the right or left. As an aid to seeing this movement, hold the front scale down. If only one deflector has side movement, or if both deflectors move toward the center, interchange deflectors. The best condition prevails when both deflectors tend to move outward when the platen is rotated in a normal feeding direction.

Check to see if play is present in the right-hand platen bushing and whether the platen

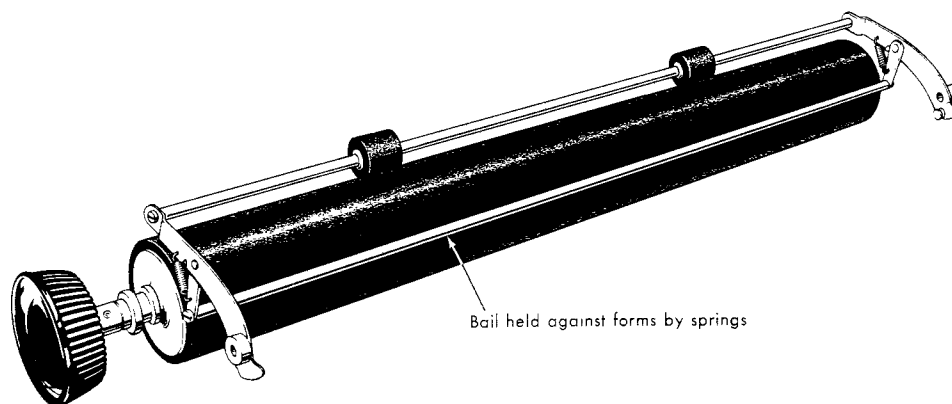


Figure 84. Paper Ironing Bail Assembly

guide plate is braced against the carriage frame by a .040" washer inserted between the two and held in place by the right front carriage end cover screw. If the platen guide plate has riveted studs bearing against the carriage frame just behind the platen bushing, the washer will not be required.

To insure straight paper feeding, the deflector must be straight. Test by holding the deflector level in one hand, rest the platen in the deflector and spin it. If the platen tends to run out one end of the deflector, reform the deflector by twisting gently until the platen runs true.

Check feed roll pressure again as a final step.

Forming the rolled edge of the deflector will assist greatly in overcoming wrinkling of stencils and thin papers on machines where the material is all, or nearly all carried on one deflector. In applications where the stencil or paper must work on more than one deflector, as in a 16-inch machine, forming the deflector will correct wrinkling, except for that part of the material which travels over the gap between deflectors.

In order to overcome this trouble, a shaft similar to a bail shaft (Figure 84) may be suspended

from the bail arms in such a manner as to iron out wrinkling as the paper or stencil enters over the rear feed rolls. In addition to the ironing effect, another effect is achieved in generating a slight static condition during line spacing as the paper is drawn sharply across the steel rod. This effect also assists in preventing wrinkling by causing the parts of a form or stencil to adhere to one another very tightly.

The ironing bail is held loosely by shoulder screws in the ends. The bail is not required to roll with the paper and does not interfere with rolling the paper backward unless the bottom edge of the paper has been carried past the ironing bail. Lifting the paper bail will also lift the ironing bail out of the way so that the paper may be rolled back if it has been rolled farther than the ironing bail.

The paper ironing bail assembly is available for special applications as required.

#### Roll Back of Forms

Certain papers or forms do not lend themselves to rolling back the platen after having made an erasure approximately 2-1/4" from the bottom, just after the form has left the rear feed rolls. Rolling the platen back to recover the writing

position can result in the forms being disturbed when the bottom edge of the first sheet contacts the rear feed rolls and becomes slightly misplaced upward. The next typing will fall slightly below the writing line. This condition may be rectified by removing the deflector and, with a screw driver, forming the lip of the metal just in front of the rear feed rolls so that the paper, in rolling back, will be deflected up onto the rear rolls instead of butting against them and being shifted. Forming the metal too high could cause it to show carbon marks.

### Paper Table Collar Adjustment

Rear rail parts may be made more readily accessible for adjustment by moving the paper table to a vertical position.

It is first necessary to move the retaining collars so that the set screws are in a forward position, as shown. The paper table is then raised as far as possible, after which the paper bail assembly is raised simultaneously with the paper table. This procedure will allow the back edge of the paper table to fit into the form of the paper bail springs and hold the paper table in the raised position (Figure 85).

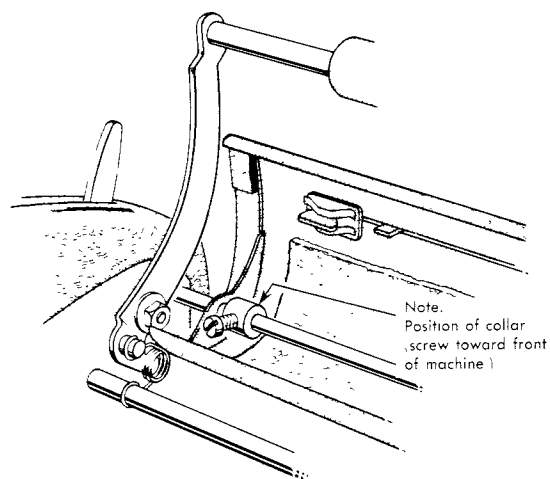


Figure 85. Paper Table Collar Adjustment

### Carriage Return (Toggle Type)

The carriage return cam may be removed by first removing the power roll and the cam knockout bar. Loosen the screw that holds the short cam bearing rod on the right-hand side so that the rod can be pulled out the right side of the machine. The setscrew will be found on the top of the cam knockout bar. Disconnect the links and lift the cam out.

Removal of the clutch plate and disc may be accomplished after removing the screw from the top of the clutch operating arm. Removal of the clutch pulley requires that the clutch operating arm be disconnected at the bottom, because the adapter bracket around the bottom of the machine will not permit the operating arm to tilt far enough to the right to allow the clutch pulley to slide off the power roll shaft.

The carriage return mechanism is required to return the carriage to the margin position, line space the platen, and unlatch the clutch automatically. It is also required to hold to the margin when operated repeatedly either by rapid repeated operation of the key or when a repeating carriage return cam is installed.

In order to meet these requirements the clutch disc, pulley and plate (Figure 86) must be clean

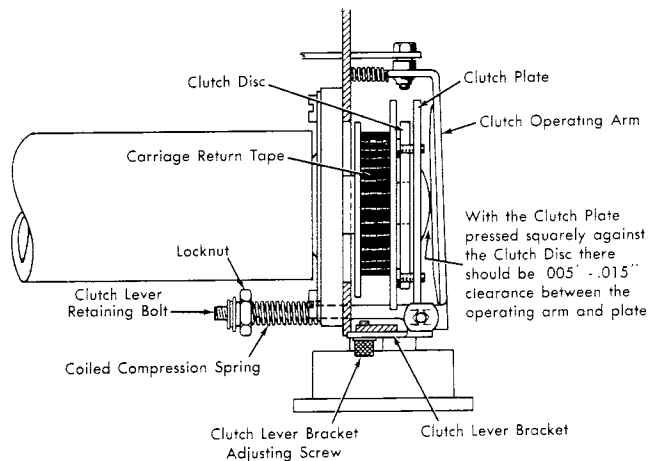


Figure 86. Clutch Parts

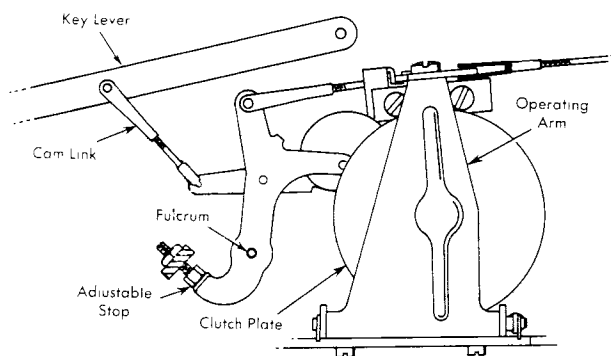


Figure 87. Carriage Return Clutch

and free from oil or grease, and the mechanism must be adjusted according to the procedure outlined.

The carriage return cam should be adjusted, by means of its stop (Figure 87), so that the cam will clear the power roll by .010" to .015", or so that the cam lug will fall just behind the cam release lever when the cam is tripped with the power off.

The cam release link should be adjusted so that the cam will be released when the key has completed  $1/2$  to  $3/4$  of its total travel.

The toggle type of clutch (Figure 88) requires that the toggle operating link, from the cam to the toggle, be adjusted so that when the cam is positioned with its high point resting on the power roll, the toggle will be brought just to rest against its stop. Adjust the clutch toggle lever and link assembly initially so that the link swings  $1/32$ " past its fixed center when the clutch

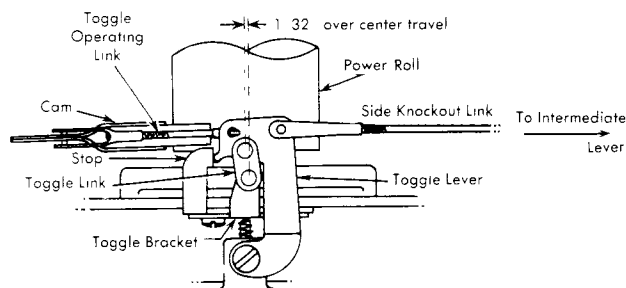


Figure 88. Clutch Toggle

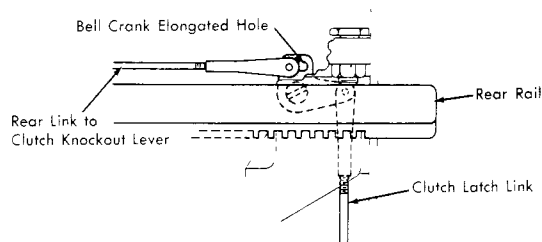


Figure 89. Side Knockout Link Adjustment

mechanism is engaged. Elongated holes in the toggle bracket provide this adjustment.

The clutch toggle knockout lever, located on the rear rail, is lifted into the path of the left-hand margin stop by means of connecting links from the clutch toggle lever back to and along the rear rail. The side link has an adjustable end on the rear which may be so adjusted that the elongated hole in the bell crank will lie parallel to the rear rail, with the cam at rest (Figure 89).

After the side link is adjusted, the rear link may be adjusted to lift the clutch knockout lever, so that with the clutch locked, the left margin stop will contact the upper surface of the clutch knockout lever  $3/16$ " down from the top of the incline and will glide approximately  $1/16$ " at which point the clutch will be knocked out or released (Figure 90). Tape the switch insulator down if necessary so that it will insulate but will not interfere with the clevis of the rear link.

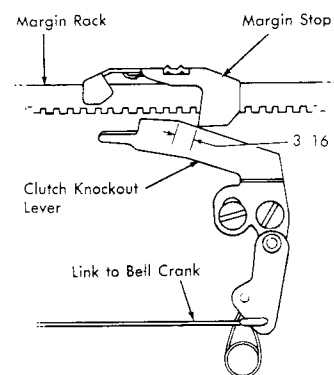


Figure 90. Clutch Knockout Link Adjustment

If the clutch fails to unlock easily, review the adjustments of the clutch toggle lever and reduce the amount of over-center travel from  $1/32''$  to  $1/64''$ . Failure after this adjustment may be traced to a bind in the riveted mechanism, or to a weak hairpin spring on the bottom of the knockout lever. The intermediate lever or bell crank, where the side link and the rear link join, should be examined also, since the link clevis may join the lever at an angle sufficient to cause a bind.

The tip of the clutch knockout lever is designed to prevent locking of the carriage during simultaneous operation of the carriage return and tabular mechanism. The tip of the knockout lever will bear against the lower part of the angular plate under the flat top of the tab lever and will prevent the clutch from locking, or if locked, will unlock it.

This tip is adjusted by forming with a bending tool (Figure 91) until, with the clutch locked, the tip will just touch the bottom of the angular plate of the tab lever at rest, and the knockout lever should be allowed to rise to its proper height as in Figure 90.

To test for proper operation, lock the clutch and slowly swing the tab lever out by hand. The clutch should unlock before the tab lever reaches its latching position.

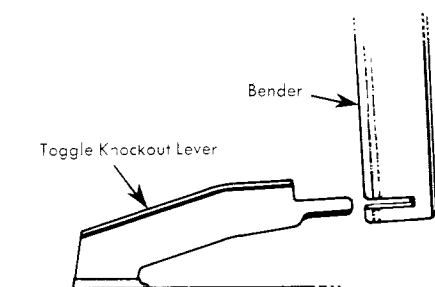


Figure 91. Forming the Tip of the Knockout Lever

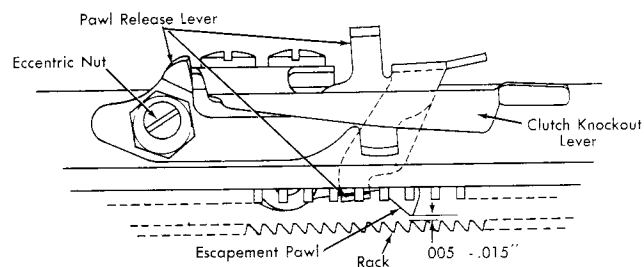


Figure 92. Pawl Release Lever Eccentric

In order to eliminate noise and wear on the escapement pawl and rack during carriage return, the escapement pawl release lever is provided with a tip which bears against the shoulder of the toggle knockout lever. Movement of the knockout lever, as it rises, will move the pawl release lever so as to pull the pawl out of the rack. The amount of clearance may be observed by sighting along behind the rack from either end of the carriage. Adjust the clearance by means of the eccentric nut on which the pawl release lever is mounted, until the pawl clears the rack by  $1/64''$ . This adjustment is made with the clutch unlocked and is read with the clutch locked (Figure 92).

Clearance between the clutch plate and the clutch disc should be adjusted to  $.010'' \pm .005''$  by positioning the clutch operating arm bracket on the bottom of the frame, using the elongated holes at the bottom of the clutch plate bracket for this purpose (Figure 86).

To insure the proper strength of carriage return, the clutch pressure is adjustable. Adjust the self-locking nut against the coiled compression spring under the clutch until the carriage will just fail to make a  $1-1/2''$  return with the line space lever set for triple spacing. Follow this by tightening the self-locking nut until the carriage will just make the  $1-1/2''$  return with the line space lever to the rear.

"Freezing" of the clutch shaft, in machines without the solid shaft power roll, may be traced to use of the wrong oil or lack of oil in the clutch shaft bearing. Remove the shaft, clean and lubricate the bearing with IBM lubricant #6. This treatment should be given periodically, as machine use warrants, at least once a year. Replace the fiber washer on the power roll end of the shaft with a hard steel washer, part 139929, and keep the burr side of the washer away from the bearing.

Overbank is the term applied to the amount of play between the left-hand margin stop and the flat top of the tab lever when the carriage is resting at the left-hand margin. Overbank is adjustable by moving the margin rack to the left or right after having loosened the rack nuts at the ends of the carriage. The rack should be positioned so that when the carriage is moved slowly to a position of contact between the left margin stop and the flat top of the tab lever, the escapement pawl will click into the escapement rack under the carriage at the instant of contact. No pressure should be exerted to force the tab lever during this test (Figure 93). When adjusting the margin rack it is advisable to lock the two nuts on one side while the other two remain clear of the opposite side. The two other nuts may then be tightened against the carriage frame. This procedure will prevent any warping of the carriage sides.

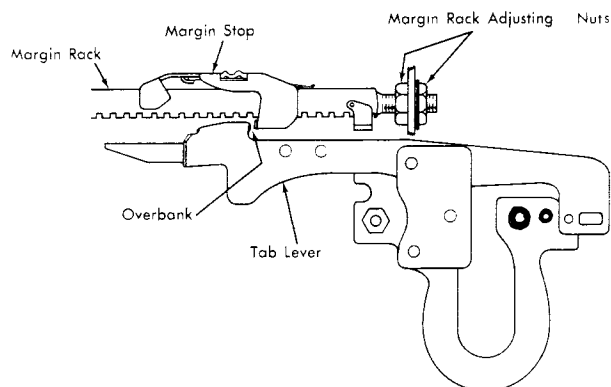


Figure 93. Overbank Adjustment

### Carriage Return (Latch Type)

The roller latch type of clutch (Figure 94) was developed to provide a positive locking clutch mechanism which would unlock more easily than the toggle type of clutch.

The cam action, through the short cam link, pulls the clutch lever forward far enough to permit the latch to be sprung into the position where it will hold the clutch lever secure. The latch spring is required to actuate the latch and, through the two long links and the bell crank under the rear rail, it is also required to lift the clutch knockout lever, operate the pawl release lever so as to pull the escapement pawl out of the rack and, finally, to actuate the back space interlock.

Adjust the cam link so that when the clutch is open as far as the roller will permit, the cam will be just touching its stop. The stop should have been adjusted to give the cam .010" to .015" clearance with the power roll. This clearance can be gaged by tripping the cam with the power off. The cam release lever lug should fall just behind, or on the rear half of the cam lug.

Adjust the latch link so that when the clutch is unlatched, the slot in the clutch bell crank will be parallel with the rear rail.

Adjust the latch eccentric for a clearance of .010", plus or minus .005", between the latch and the clutch lever when the cam is on its high point. The high point of the eccentric must be kept in the outer half of its circle. If minimum clearance cannot be obtained by adjusting the eccentric, the cam link may be set one or two turns tight, but this should be avoided as far as possible because it would prevent the cam lever from resting on the roller.

Adjust the tip of the clutch knockout lever by

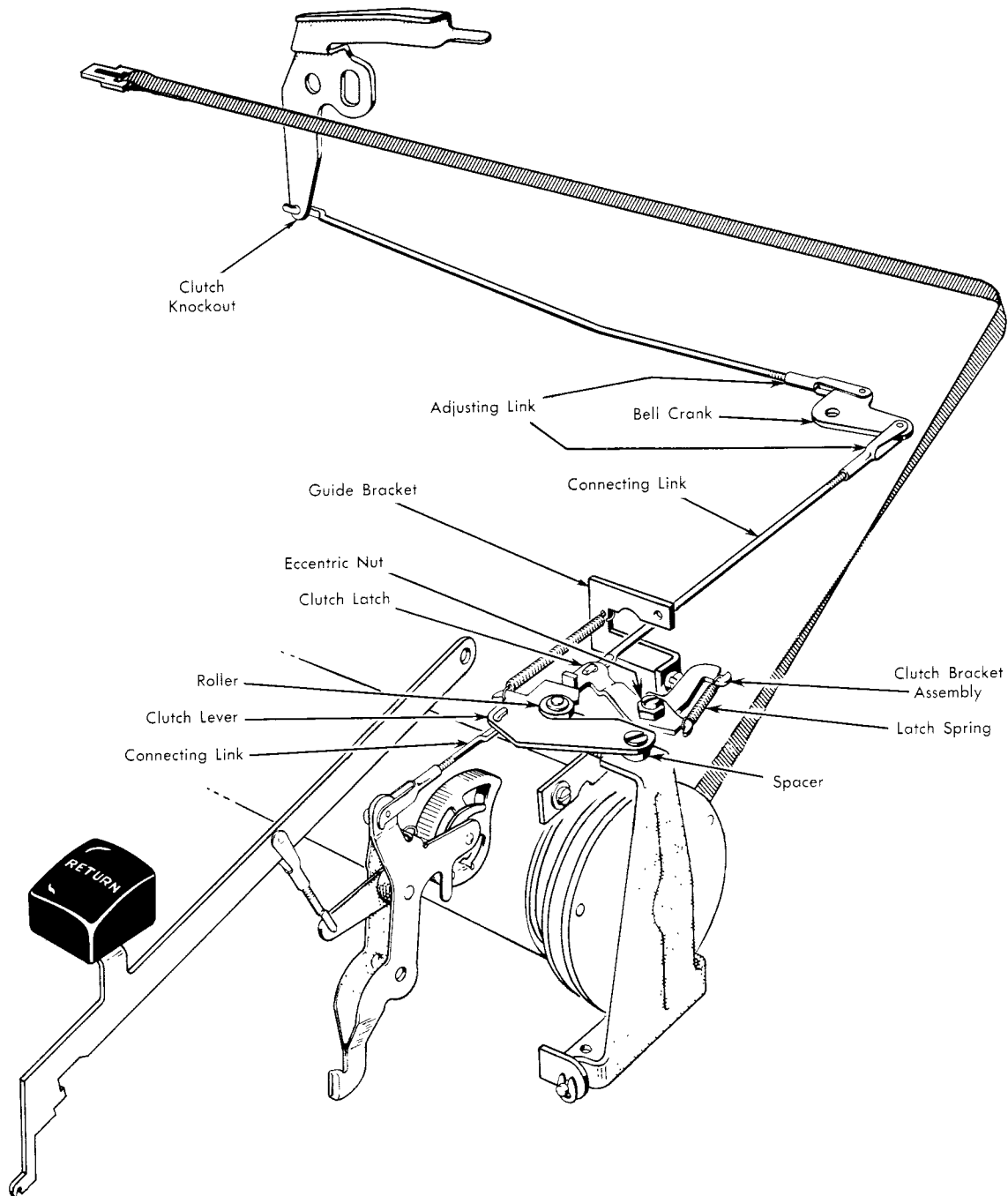


Figure 94. Standard Latch Clutch

forming, if necessary, so that as the tip touches the under side of the tab lever angle plate, the knockout surface will clear the margin rack by .010" to .015". This should be checked with the tab lever in the rest position.

Adjust the clutch knockout lever link so that

when the cam is on its high point, the latch will engage the clutch lever by  $\frac{3}{64}$ ", the thickness of the latch. Form the switch insulator down, so that it will insulate but will not interfere with the clevis on the rear link.

Adjust the pawl release lever eccentric so that

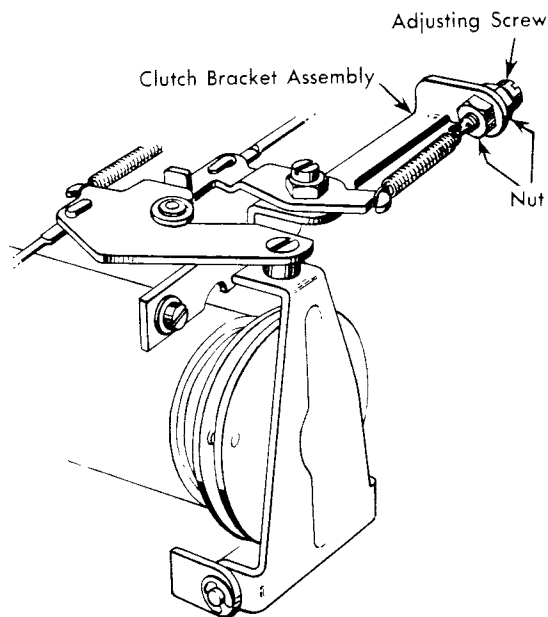


Figure 95. Adjustable Tension Latch Spring

when the clutch is latched, the escapement pawl will clear the rack by  $1/64''$ . The high point of the eccentric should be kept toward the front of the machine to provide the best leverage for its operation.

A variation of the roller latch type of clutch incorporates an adjustable tension latch spring (Figure 95). Insufficient tension in the latch spring can cause a partial carriage return. After clutch and carriage return adjustments have been properly made, spring tension should be adjusted to insure proper return by adjusting the locking nuts on the latch spring bracket. Excessive tension on the latch spring can cause the carriage to lock if carriage return and tabular are operated simultaneously. The clutch bracket assembly is interchangeable with similar parts on other machines.

Adjust the clutch lever bracket on the bottom frame so that when the clutch plate is held against the disc by hand, the bronze insert of the plate clears the clutch operating arm by  $.005''$  to  $.015''$ . When the clutch is unlatched, the clutch pulley should be free to rotate, and

there should be no drag on the carriage return tape. When the clutch is latched, the lower, rear corner of the operating arm should be free to move at least  $1/32''$  in the spring control slot of the bracket.

Adjust the self-locking nut against the coiled compression spring under the clutch so that the carriage will just return to the margin when operated on a two-inch return with the line space lever to the rear.

#### Carriage Return (Single Link Roller Latch)

The single link, roller latch clutch (Figure 96) is a modification of the standard latch type clutch, which simplifies adjustment. This type of clutch can be used as a replacement on any application where other clutches give continued trouble, except that the Executive machine requires a double-link clutch.

The single-link clutch employs a single link running from the carriage return cam, passing through the latch and on to the bell crank under the rear rail. The link makes it possible to use the power of the cam to raise the knockout lever, pull the pawl out of the rack, actuate the back space interlock lever and latch the clutch.

Adjustment of the clutch is simplified to the following steps.

Adjust the carriage return cam stop so that when the cam is tripped the release lug will drop on the rear half of the cam lug.

Adjust the cam link so that the key lever will trip the cam when the key has been depressed  $1/2$  to  $3/4$  of its total travel.

With the tip of the clutch knockout lever held against the angular plate of the tab lever, the tip should be formed so that the left-hand margin stop will contact the upper surface of the clutch knockout lever  $3/16''$  down from the

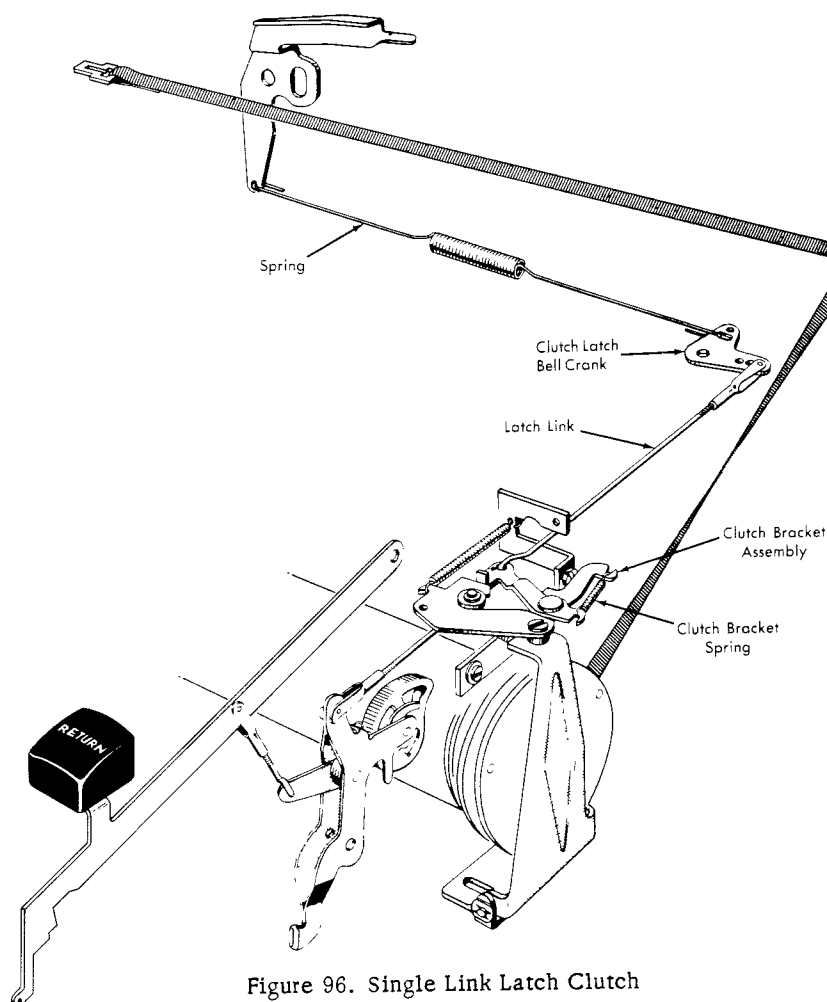


Figure 96. Single Link Latch Clutch

top of the incline (Figure 90). Currently, a dimple is positioned on the incline to represent the point of contact.

Adjust the latch link, at the cam end, so that with the cam at rest, with the clutch unlatched, and with the latch held against the lever, the holes in the clevis will match the pins on the cam.

With the clutch latched, the latch engaging the clutch lever by  $\frac{3}{64}$ ", the thickness of the latch, and with the clutch knockout lever raised to its full limit, adjust the rear clevis of the latch link to just match the outside hole of the clutch bell crank.

During the latching operation, it will be noted that the latch is pulled beyond its latched position while the cam is on its high point. This overthrow is normal and is due to the spring action of the clutch knockout link.

If the final engagement of the latch is too deep to permit a good unlatching action, shorten the latch link slightly at the rear clevis. It may also be necessary to attach the rear clevis in the second hole of the bell crank.

If the final engagement of the latch is too shallow to hold for a positive and complete carriage return, lengthen the latch link slightly at the rear clevis.

Adjust the pawl release lever eccentric so that when the clutch is latched, the escapement pawl will clear the rack by  $\frac{1}{64}$ ". The high point of the eccentric should be kept toward the front of the machine.

Clutch plate clearance should be set for .005" to .015", and the spring pressure under the clutch should be sufficient to insure a 1-1/2"

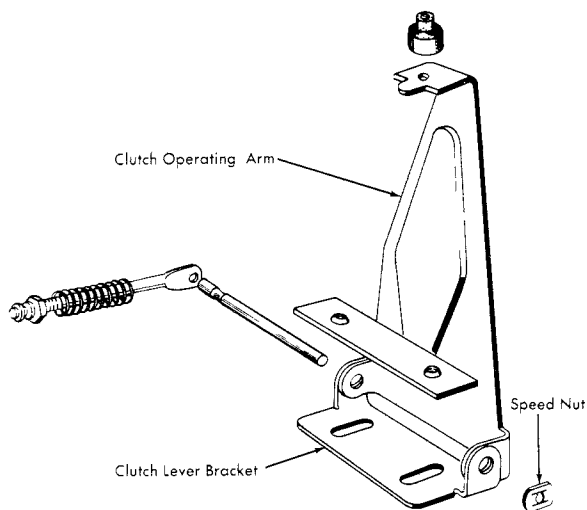


Figure 97. Clutch Operating Arm

return with the line space lever to the rear.

The rib of the clutch operating arm has been deepened to  $\frac{3}{32}$ " to reduce the possibility of deflection during operation (Figure 97). The clutch operating arm bracket has been provided with sufficient adjustability to satisfy all conditions. A clamp plate is available to adapt these parts to machines which do not have tapped mounting holes in the bottom of the side frame.

The spacer on the top of the clutch operating arm has been made thicker, consequently it may be used only with this operating lever. Binds will result if the wrong spacer is used. A shoulder, added to the clutch pulley bearing, prevents slippage of the bearing and prevents loss of adjustability of clutch plate clearance.

#### Clutch Pulley Spring

The clutch pulley spring should be adjusted so as not to interfere with fast escapement, especially as the carriage approaches the end of its travel to the left during escapement, or tabulation; however, the spring should be wound tightly enough to take up the slack in the tape and

not permit it to whip. Normally, it will be found sufficient to wind the pulley spring completely and back it off two turns before attaching the tape to the pulley.

The outer loop of the spring should be placed outside of the guide lug in the housing to eliminate friction in the operation of the spring.

If the hooked end of the spring should become broken, it is possible to anneal the broken end with a small flame, such as a lighter or match, and re-form the hook.

If the pulley spring is wound too loosely, then excessive whip in the carriage return tape results, which in turn causes the carriage to creep away from the margin during repeated operation of the carriage return key.

#### Line Space Adjustment

The index pawl carrier (Figure 98) may be removed by removing the two small nuts and washers which retain the carrier on mounting studs. In replacing the washers, the burr side (or sharp side) of the washers should be mounted away from the carrier so as to permit the carrier to travel freely without the possibility of binding on the washers.

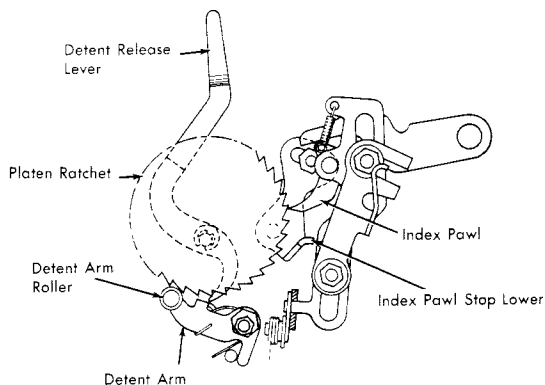


Figure 98. Line Space Mechanism

The hook lever spring should be formed so that it will positively restore the carrier up to the upper stop in the highest line space setting, but will not be too strong so that it causes the carriage return tape to whip excessively. Excess whip in the carriage return tape can cause the carriage to creep away from the margin during repeated line space operation.

The platen detent arm (Figure 98) should be adjusted, by means of the eccentric nut on which it is mounted, so that the index pawl may enter the ratchet one-third of the distance down on a tooth. The platen must be removed to make the adjustment. The high point of the eccentric nut should be kept in the upper half of its circle.

The lower index pawl stop must be adjusted, after any change in the detent adjustment, so that it stops the travel of the index pawl carrier at the instant when the ratchet has positioned itself securely on the detent roller with no play forward or backward. Adjust the lower index pawl stop with the platen installed, by loosening the locking screw (Figure 99) and tapping or prying the stop bracket with a small screw driver. Lock the screw and check the adjustment by moving the carriage to the extreme left and operating the line space mechanism by hand. A sharp pull on the carriage return tape will actuate the index pawl and rotate the platen. Hold the pawl carrier down with the tape and try

to rotate the platen with the left-hand platen knob. Any play that is felt should be removed by further adjustment of the lower pawl stop.

Proper line spacing depends very largely on proper paper feed. After having checked the adjustments outlined here, the adjustments listed under the heading Paper Feed should be reviewed.

Special attention is invited to the detent arm pressure spring. If the spring is not sufficiently strong to hold the ratchet securely, heavy paper forms or cards may advance an extra part of a line space just as the bottom edge drops off the rear feed rolls. A complete line may be written with the paper in this position. When the paper is advanced to the next line, the space will then appear too small. Such a fault will appear only at a distance of approximately 2-1/4" from the bottom edge of the paper. The detent arm spring may be removed and formed stronger.

#### Back Space Adjustment

Removal of the back space cam may be accomplished by first removing the power roll and the cam knockout bar. Disconnect the operating link and the cam release link (Figure 100). The cam fulcrum rod for the right-hand functional cams may be removed after loosening the set-screw which locks it.

To remove the back space pawl bracket assembly (Figure 101), disconnect the two springs from the back space pawl and remove the two mounting screws. This will also release the tab rebound check stop bracket. The stop must be replaced on the outside of the back space pawl bracket and not between the bracket and the rail.

The back space interlock should be so adjusted

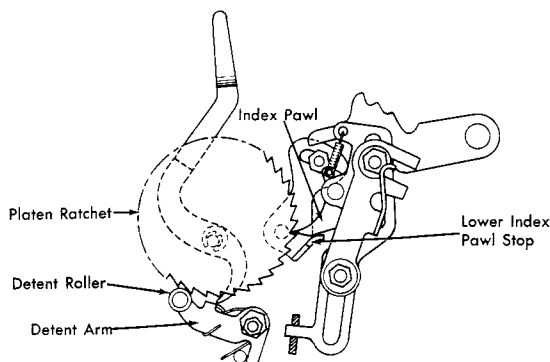


Figure 99. Index Pawl Stop Adjustment

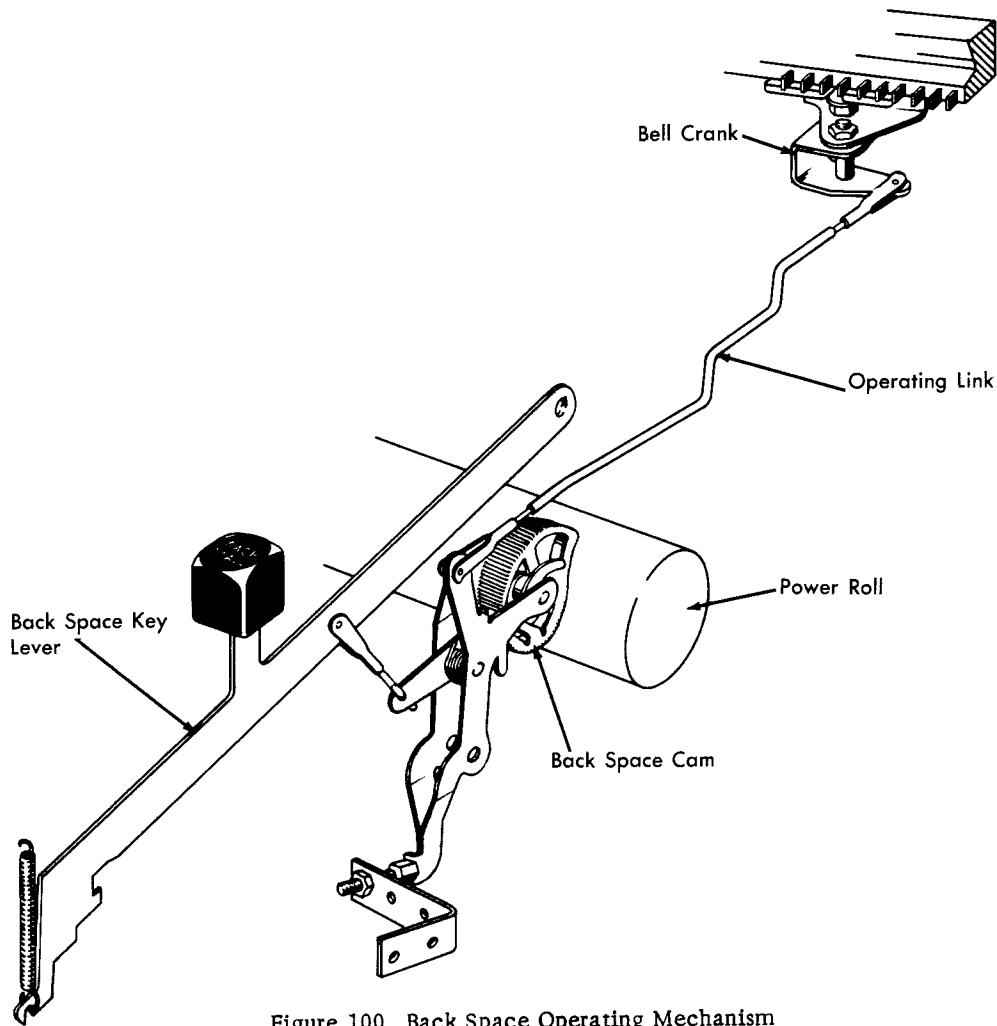


Figure 100. Back Space Operating Mechanism

that the carriage will not become locked when the back space key is operated in combination with the tab key or with the carriage return key. One function of the interlock is to block the path of the back space pawl when the pawl release lever is actuated first. This action would occur if carriage release buttons were held down while the back space mechanism was operated. The other function of the interlock is to prevent movement of the pawl release lever when the back space pawl is engaged in the escapement rack.

This condition would result from a simultaneous operation of both the carriage return key and the back space key, such as when an operator de-

sires to line space a column of single characters or to line space without returning the carriage to the margin. The condition would also result from a simultaneous operation of both the tab

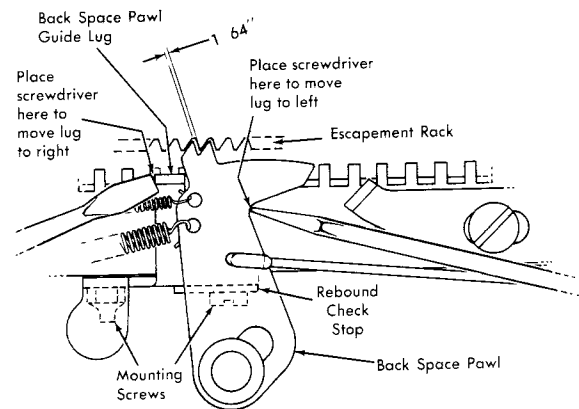


Figure 101. Back Space Pawl

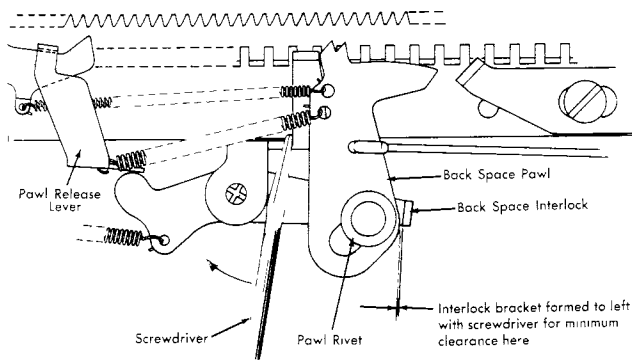


Figure 102. Back Space Interlock

key and the back space key, although the possibility of such operation would be more remote.

The best adjustment of the interlock, to meet its requirements, may be achieved by forming the bracket (Figure 102) which supports the interlock lever, in such a manner that all clearances are very close. Figure 102 shows how the bracket may be pried in one direction with a screwdriver to close the clearance between the lug on the end of the interlock lever and the edge of the back space pawl. The use of a T bender on the tip of the interlock is not effective, because it changes the form of the lever and tends to weaken the lever through fracture of the case-hardened surface.

Figure 103 illustrates a method of increasing the clearance between the lug on the end of the interlock lever and the back space pawl. The clearance must be held to an absolute minimum to block any motion of the back space pawl while

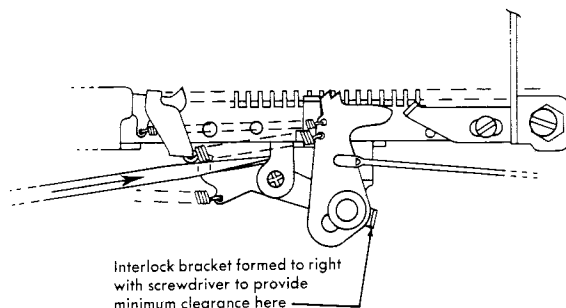


Figure 103. Increasing Interlock Clearance

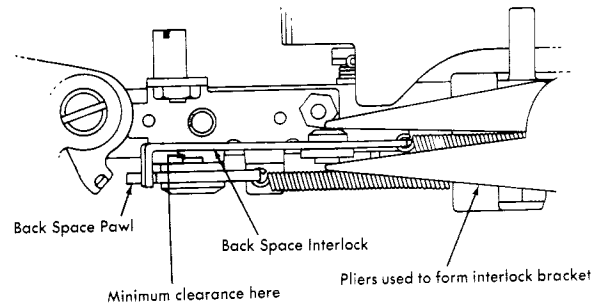


Figure 104. Adjusting the Height of the Interlock

the interlock is in the operating position. Test by holding down a carriage release button and moving the back space pawl by hand.

The height of the interlock lever may be adjusted (Figure 104) to keep the interlock as low as possible and not actually touch on the back space pawl. The back space pawl will slip under the interlock if it is formed too high.

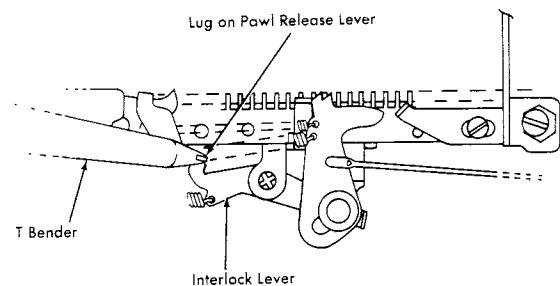


Figure 105. Adjusting the Back Space Interlock Motion

The final adjustment of the interlock (Figure 105) requires the pawl release lever to lie flat against the rear rail. Maladjustment of the two upper lugs of the pawl release lever could prevent this. Then, with a T bender, form the projecting lug on the rear of the pawl release lever so that, with the interlock at rest, the back space pawl may be moved past it with a minimum of clearance.

When the interlock lever has been adjusted

properly, the other back space adjustments may be made without the possibility of interference.

Set the adjustable stop (Figure 100) so that the cam will clear the power roll by .010" to .015". This will be indicated by the fact that when the cam is tripped, the rear lug of the cam release lever will fall just behind the cam lug. The operating link must be attached so that the spring on the bell crank (Figure 106) will hold tension against the cam and will hold the cam against its stop. Final adjustment of the link must be made later.

Adjust the cam release link (Figure 100) so that the cam will be released when the key has completed 1/2 to 3/4 of its total travel.

Adjust the back space pawl guide lug (Figure 101) so that the pawl will enter the escapement rack with approximately 1/64" clearance between the faces of the pawl teeth and the rack teeth. The lug must be formed either to the right or to the left until this condition is achieved. The forming may be accomplished by placing the end of a screwdriver against the left side of the lug and tapping on the tool until the lug has been moved far enough to the right. If it is required that the lug be moved to the left, then the point of the screwdriver should be placed at a point described as the throat of the back space pawl (Figure 101).

Before the lug is formed in either direction, a study should be made to determine if the pawl is entering the proper rack tooth. Operate the back space slowly by hand and observe that the carriage is moved one space to the right to meet the stop. If the pawl enters the rack one space too far to the left, the carriage may be moved two spaces to the right instead of one. Then, if the back space stop is adjusted to the left, in an attempt to halt the carriage after only one

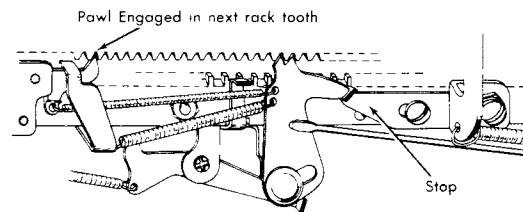


Figure 106. Back Space Stop Adjustment

space, the stop will run out of adjustment. If the lug has been formed too far to the right, the carriage will move part of a space to the right and be stopped by the back space stop, even though the stop has been adjusted as far to the right as possible.

The back space stop must be adjusted by loosening its holding screws just enough to permit the stop to be tapped into position (Figure 106). The stop should halt the travel of the carriage by stopping the back space pawl as soon as the escapement pawl drops into the next tooth of the escapement rack (Figure 106). The adjustment of the guide lug and back space pawl stop must be set very close for heavier carriage machines such as formswriters and long carriage machines.

The back space stop must also be set so that with the interlock lever actuated, the back space pawl will clear the stop by 1/32" when the pawl is operated (Figure 107). This adjustment, as well as the other back space adjustments, may be checked visually with the aid of a mirror while operating the power roll by hand.

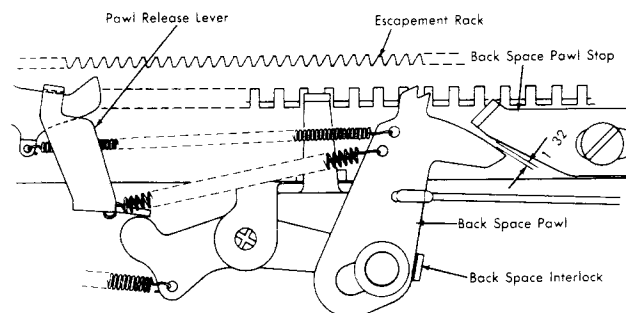


Figure 107. Back Space Stop Clearance

The operating link should be adjusted to remove excess play and overcome lost motion (Figure 100). With the parts at rest, there should be approximately  $1/64$ " of play between the back space link and the hole in the bell crank on the rear rail. Lack of any clearance at this point might indicate that the pawl is not resting against its mounting stud and thus could interfere with the free operation of the back space interlock lever.

### Tabular Mechanism

The tabular operating cam can be removed by first removing the power roll and the cam knockout bar. Disconnect the links and release the cam by removing its fulcrum rod. On machines equipped with the solid shaft power roll it will not be necessary to remove the power roll.

To remove the tab lever assembly, first disconnect the link from the tab actuating lever. Remove the margin rack and preserve its adjustment by keeping the left inside nut in its adjusted position. The tab lever may then be removed by removing its two mounting screws. One of the mounting holes is elongated to permit a springing of the horseshoe-shaped tab lever bracket during tabulation or carriage return. In this manner part of the shock of these operations is absorbed. The metal in the bracket and in the tab lever has been specially treated to take up shock.

In replacing the tab lever assembly, the proper part, identified by the narrow tip, must be used to avoid interference with the line lock parts (Figure 109).

To facilitate removal of the tab latch, it is advisable to back out the mounting studs that support the clutch knockout lever. Further clearance may be obtained by removing the margin rack.

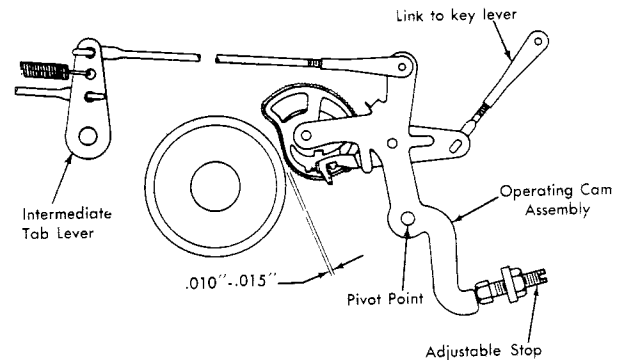


Figure 108. Tabular Mechanism

To adjust the cam, first adjust the cam stop so that the cam clears the power roll by  $.010$ " to  $.015$ " (Figure 108), or so that when the cam is released, with the power off, the cam lug will just drop behind the non-repeat lug of the release lever. Next, adjust the link from the key lever to the cam so that the cam is released when the key is  $1/2$  to  $3/4$  depressed.

The link between the cam and the intermediate lever should be adjusted so that the forward edge of the intermediate lever will be vertical with respect to the frame.

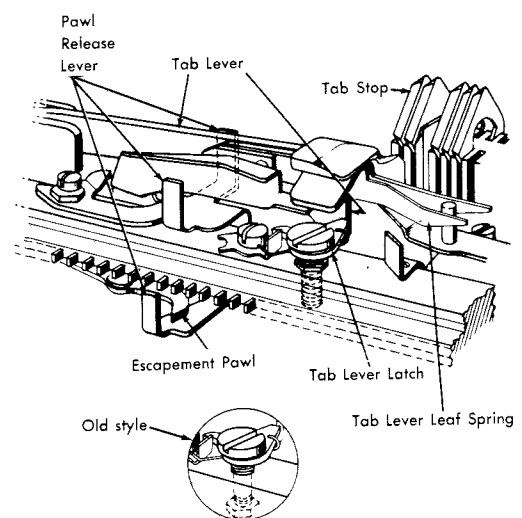


Figure 109. Tab Lever Assembly

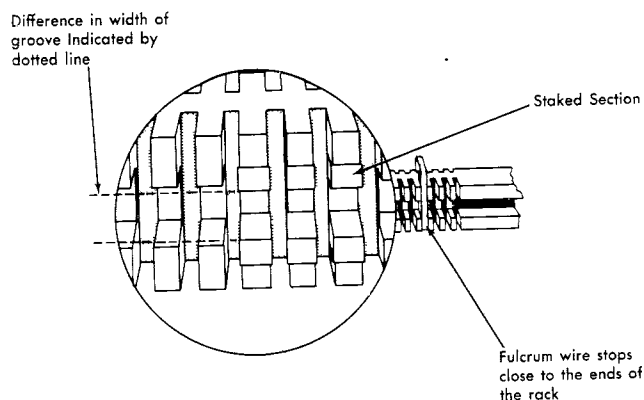


Figure 110. Tab Rack Section

The height of the tab lever should be adjusted so that it will just clear the under side of the margin rack by .010" to .015". This adjustment is made by means of an eccentric stud on which the tab actuating lever rests.

The tab rack is peened, or staked, at intervals along the fulcrum wire groove (Figure 110) to hold the fulcrum wire more rigid.

The tab stop fulcrum wire has been made long enough to carry stops closer to the ends of the tab rack. This prevents the tab lever from getting behind the fulcrum wire stop or the tab lever final stop. The tab rack must be squared up so that the engaging end of the tab lever is parallel with the set tab stops when sighted from the end of the carriage. Being out of square may contribute to tab rebound trouble, since the bottom of the stop could be missed by the rebound check.

Clearance between the left-hand faces of the tab stops and the engaging face of the tab lever should be from .002" to .015", tested at about 10 or 15 different places along the rack, depending on its length (Figure 111). Hold the carriage so that a set tab stop is even with the tab lever. Slowly move the tab lever out toward the rear by hand and observe the amount of clearance between the parts indicated. The continued

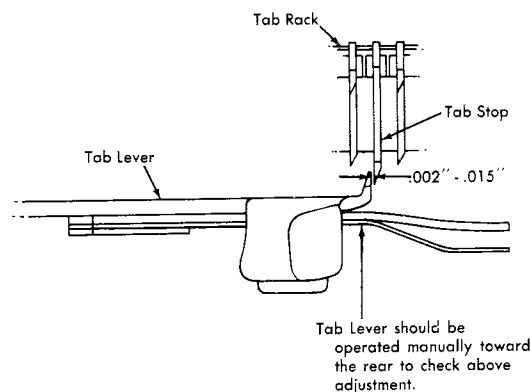


Figure 111. Tab Rack Lateral Adjustment

motion of the tab lever will remove the escapement pawl from the rack, and the reading will have no value, unless the carriage is held rigidly during the test. Adjustment may be made by means of the mounting nuts on the ends of the tab rack and should be made at one end while the nuts remain loose at the opposite end. The nuts at the opposite end may then be tightened to their proper position without the danger of drawing in the sides of the carriage.

The tab latch should be adjusted (Figure 112) so that the engaging end of the tab lever will overlap the tab stop when set, by 1/2 to 2/3 of the distance between the forward edge of the tab stop and the front face of the tab rack when the tab lever is latched out. The tab latch is mounted on the eccentric spacer which provides the necessary adjustment. At one time, the tab latch was mounted on an eccentric shoulder of the tab

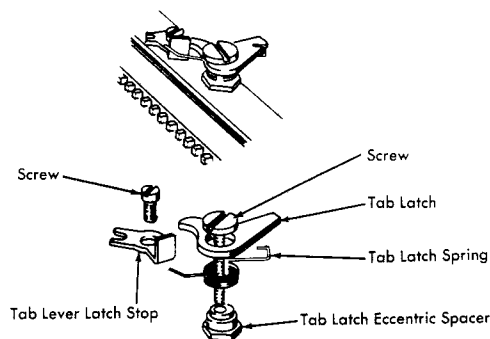


Figure 112. Tab Latch Eccentric

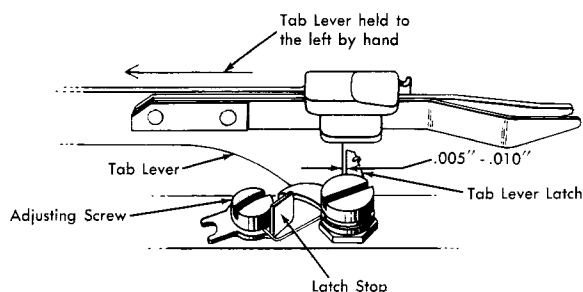


Figure 113. Tab Latch Stop

latch stud which was tightened in place by a nut on the bottom of the rear rail. In either case the high side of the eccentric should be kept toward the left, while the eccentric is turned to bring the latch forward or back to its proper location.

The tab latch stop should be positioned under its holding screw so that, with the tab lever held toward the extreme left, there will be a clearance of .005" to .010" between the left-hand edge of the latch and the right-hand edge of the tab lever at the point where the tab lever meets the latch during rest (Figure 113).

With the type of latch stud and latch stop shown in Figure 114, it is necessary to loosen the nut on the bottom of the rear rail before shifting the latch or the latch stop.

The tab rebound check is to be set, by means of the eccentric nut on which it is mounted so that, with the high side of the eccentric toward the rear of the machine, the left end of the rebound check lever will spring into the checking position

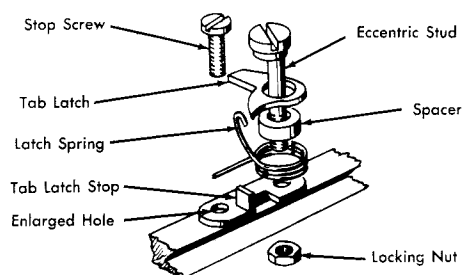


Figure 114. Tab Latch Eccentric Stud

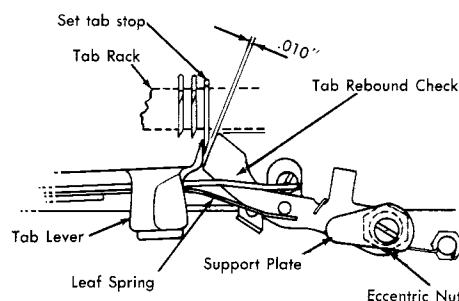


Figure 115. Tab Rebound Check

with a maximum of .010" clearance between the rebound check and the right-hand face of the tab stop. Excessive clearance at this point will result in rebound trouble during tabulation. Rebound trouble always appears as short tabulation, as if the carriage had actually stopped short of the required position. Actually the carriage reaches the proper position but bounces backward to the right if the rebound check does not operate correctly (Figure 115).

The tab rebound eccentric stud, located just in rear of the rebound check lever (Figure 116) must be set to allow .010" to .015" clearance between the corner of the rebound check and the front face of the rack.

The rebound check must not interfere on the bottom of the tab lever, but must be high enough to catch securely on the tab stops, flush with the bottom of the stop or, preferably, .010" above the bottom. Height of the rebound check lever is adjustable by forming the small plate, called the screw support, on the top of the rebound check lever.

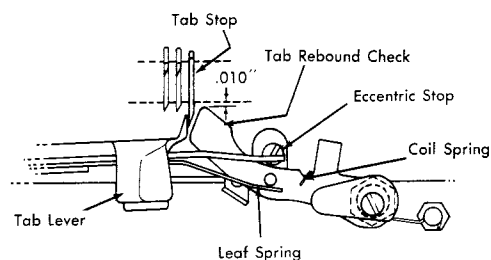


Figure 116. Rebound Eccentric Stop

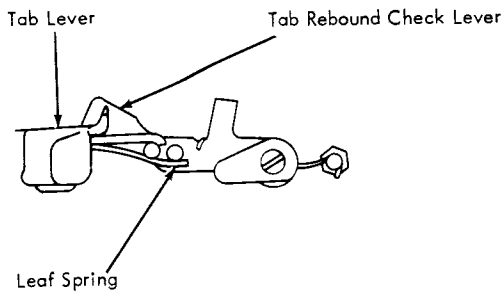


Figure 117. Tab Lever Tip and Leaf Spring

The rebound check is actuated by a leaf spring attached to the tip of the tab lever (Figure 117). Proper balance must be made between the tension of this spring and the coiled spring under the rebound check in order to snap the rebound check into its operating position in time to prevent rebounding of the carriage during tabulation. If the leaf spring is formed too far to the rear, the rebound check will not restore to rest as quickly as the tab lever and may get caught by a tab stop when carriage return is operated. If the leaf spring is formed too far forward, the tab lever will not rest parallel with the rear rail, but will project out to the rear slightly and, in this manner, may cause the tab governor pawl to lie too close to the friction plate and sometimes drag or catch.

The rebound check lever adjustments must be so handled that they will result in holding the tab lever in a rest position which will keep the tab governor pawl as far out of the tab governor ratchet as possible. The tab rebound bracket stop should be formed so that the stud on the rebound check just touches the formed tip of the tab lever. Form the tip of the tab lever so that the tab lever lies parallel, as nearly as possible, with the rear rail, but that it does not bind on the sides of its mounting bracket. If the tab operating link is too short, it will prevent the tab lever from restoring to a proper rest position.

The tab lever leaf spring should be formed so that it just touches the stud on the rebound

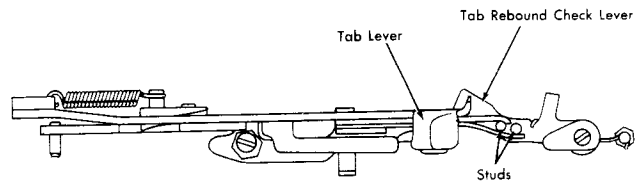


Figure 118. Stud Added on Rebound Check

check. The correct tension on the rebound check spring, under the rebound check, will be observed by unhooking the spring from the stud and permitting the hooked end to be free. The beginning of its hook will lie just over the front edge of the rear rail.

An improved design of the tab rebound check lever has been made to give positive unlocking action when the tab and carriage return are operated simultaneously. This is accomplished by using two upright studs on the rebound check and designing the tip of the tab lever to engage the left-hand stud (Figure 118). This design makes it possible to disengage the tab rebound check faster and thus prevent it from locking behind a tab stop when the tab and carriage return are operated together.

The tab lever tip is to be formed so that the rebound check lever will restore with the tab lever and will not lag. Operate the tab lever forward and backward by hand to test the adjustment.

The rear, upright lug on the pawl release lever should be so formed as to remove the escapement pawl  $1/64$ " from the escapement rack during tabulation (Figure 119). This clearance may be easily checked by holding the carriage by hand while the tab lever is latched out. Sighting along the escapement rack will show that the escapement pawl just clears the rack.

The link to the actuating lever (Figure 108) should be adjusted so that when the cam is resting on its high point, the tab lever will

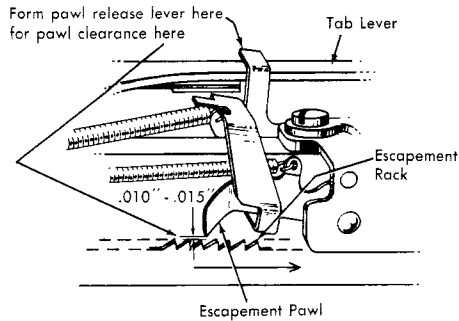


Figure 119. Tabular Pawl Release Adjustment

just clear the front face of the tab rack and will be pulled out far enough to permit the tab latch to clear the tab lever safely. This adjustment will insure that when the tab lever is at rest, the actuating lever will not bear against it.

While the tab lever is held in the above position--with the cam on its high point--the tab lever stop, on the top of the rear rail, may be adjusted in position to prevent overthrow of the tab lever (Figure 120). If the stop is set too far to the rear it may bind off the movement of the tab lever and prevent it from latching.

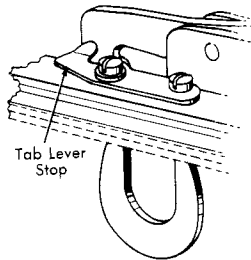


Figure 120. Tab Lever Stop

Carriage tension should be checked by holding the carriage so that the tab lever is even with the last tab stop. Latch the tab lever out and let go of the carriage. There should be just enough main spring tension to unlatch the tab lever without hesitation. Tension may be adjusted by placing the loop in the carriage tension tape on different prongs of the main spring drum.

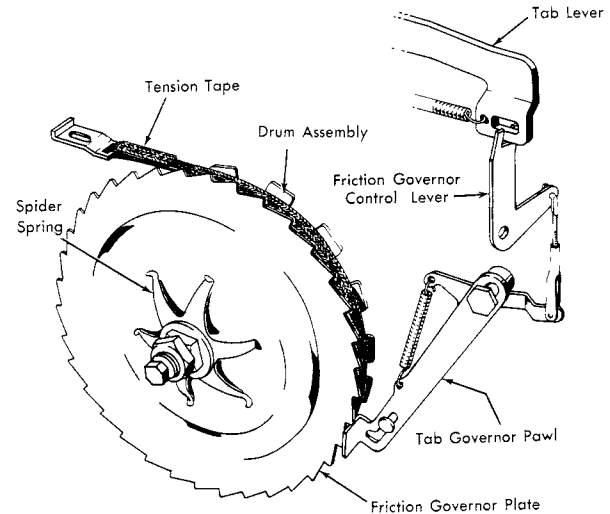


Figure 121. Tab Friction Governor

The friction governor (Figure 121) minimizes shock to parts by preventing excessive velocity of carriage travel during tabular operation.

The tab governor pawl link should be so adjusted that when the tab lever is latched out in the operating position, the end of the pawl will engage the teeth of the ratchet by the thickness of its own metal. If the link is too long, the pawl will drag on the friction plate during escapement and might cause type piling.

The pressure of the friction governor plate is to be adjusted, by means of the two locking nuts on the hub of the main spring drum, until excessive shock has been eliminated. Too much pressure will cause slow tabulation. The tab lever should dependably unlatch when tabulating from a point ten spaces to the left of the last tab stop. Carriage tension on the main spring must be properly set prior to this test.

The tab set bracket (Figure 122) should be formed so that when the tab stops are in the non-operating position, there will be a clearance of approximately  $1/32$ " between the tab stops and the tab set lever.

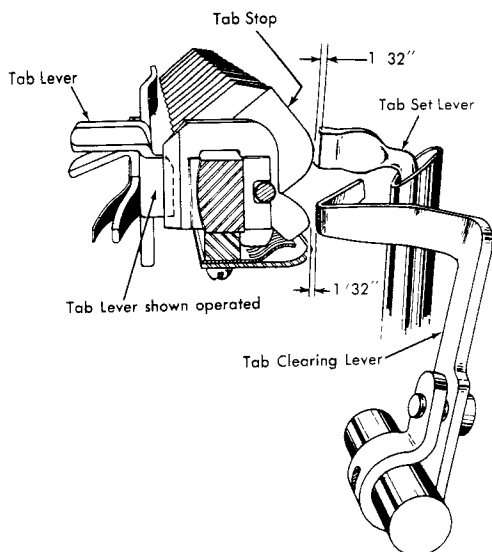


Figure 122. Tab Set and Clear Bracket

The tab clear bracket should be so formed that when the tab stops are in the operating position, there will be a clearance of approximately  $1/32''$  between the tab stops and the tab clear lever.

The tab set and clear links should be adjusted to such a length that when the buttons are at rest, the slope of their upper surfaces will point in a line parallel to the plane of the keyboard (Figure 123). The carriage may be made to tabulate to any space on machines of 6-2/5, 8, 9, 10 and 12 pitch; every other space on 14 and 16 pitch machines. Repeat tabulation may be made to every space on 6-2/5 pitch machines; every other space on others.

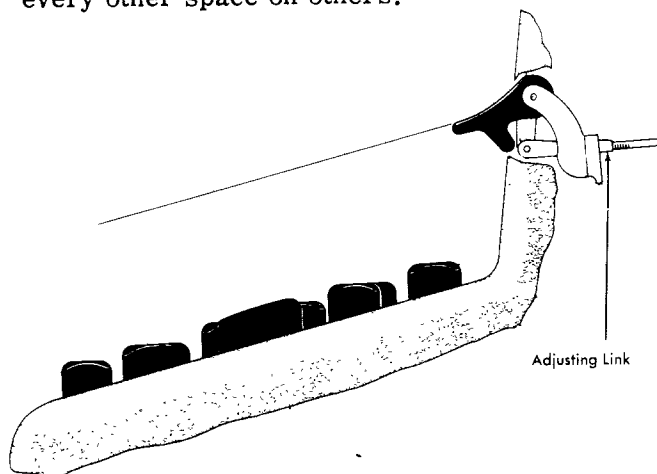


Figure 123. Tab Set and Clear Buttons

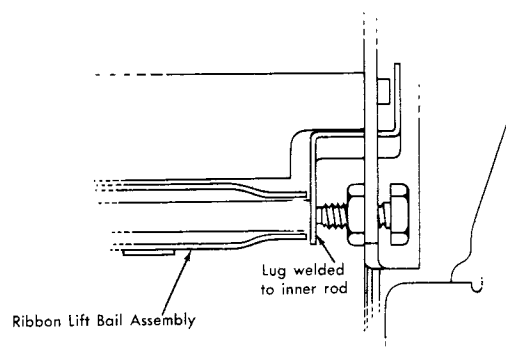


Figure 124. Ribbon Lift Bail

### Ribbon Control Adjustment

The ribbon lift bail assembly (Figure 124) may be removed by first disconnecting the linkage and backing off the pivot screw from either side frame after having loosened the locking nut.

The cam (Figure 125) may be removed by disconnecting its springs and links and removing the screw which holds the cam mounting stud. The ribbon feed mechanism may be removed

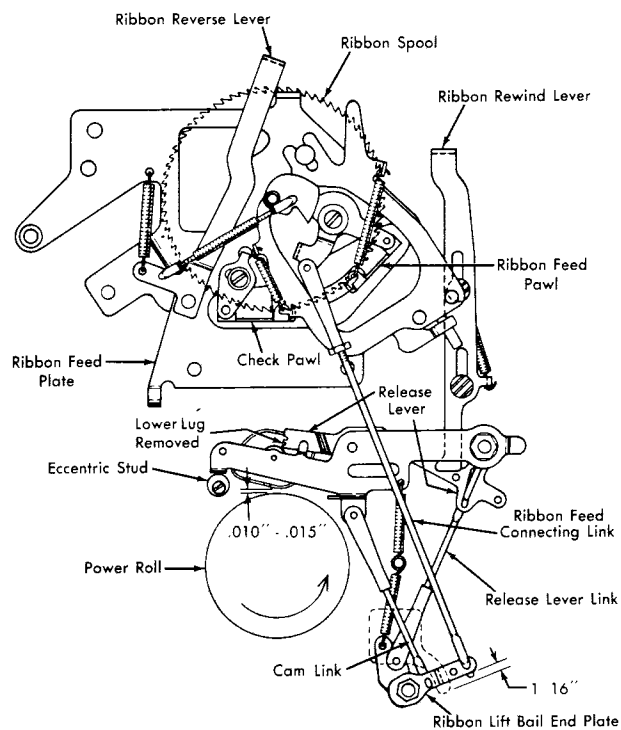


Figure 125. Ribbon Feed Mechanism

from either side frame by disconnecting the linkage and removing the mounting screws. The ribbon lift mechanism (Figure 127) may be removed by disconnecting linkage and loosening the mounting screws. The ribbon lift bail assembly should be adjusted to pivot freely, centered equally between the two side frames.

The ribbon feed cam should be set to clear the power roll just enough to permit its release lever lug to drop behind the cam lug upon release of the cam. This adjustment is made by means of an eccentric stud upon which the cam rests. The eccentric stud is covered by a vinylite sleeve which is held in place by a shoulder on the stud. The proper release of the ribbon feed cam may be observed, with the power off, by looking down on the top of the cam and operating any type bar by hand. The ribbon feed cam release lever should carry only one lug, the upper one. Figure 125 indicates that the cam release lever was originally designed with two lugs, the lower one of which would arrest the rotation of the cam after one-half revolution. The lower lug should be broken off because it can strike on one of the cam lugs if the cam happens to be in just the right position when the next key is released. If the cam lug interfered with the release lever travel in this manner, a light impression or typing failure would result, because the release lever for the ribbon feed cam is actuated by the cam lever, through the ribbon lift bail.

The cam release lever link (Figure 125) should be adjusted so that the cam will be released when the type face is approximately  $3/4$ " from the platen. A variation in this tripping point between different type bars indicates that the ribbon operating bail is curved.

The link from the cam to the end plate on the ribbon operating bail is to be adjusted until the formed lug which passes through the side frame

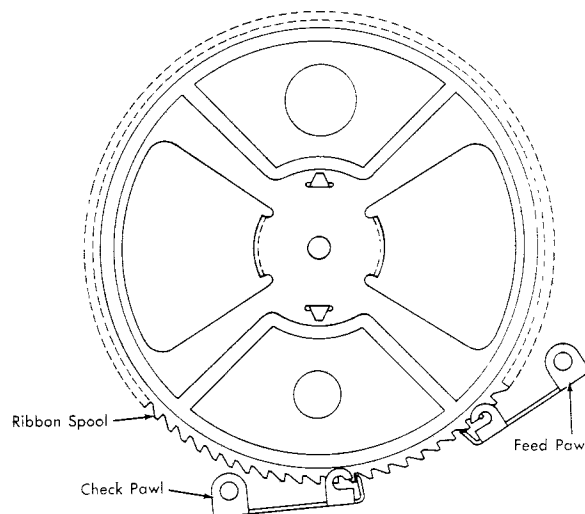


Figure 126. Check Pawl Adjustment

rests  $1/16$ " above the bottom of the arc shaped slot in the side frame. This adjustment may be made by disconnecting the cam link and, by reaching down with a springhook from the position of the left-hand ribbon spool, the link may be turned. The ribbon feed connecting links should be adjusted so that when the ribbon feed cam is on the high point, the reversing latches can just clear the lugs on the ribbon feed bell cranks. Observe the adjustments with the feed pawls engaged in first one spool and then the other.

The check pawl is to be adjusted by means of its mounting screw. Loosen the screw and move the pawl backward or forward until, with a spool tooth resting against the check pawl, the feed pawl will rest half way between two teeth. With the cam rotated to its high point, the feed pawl should feed two full teeth plus enough to engage the check pawl safely.

The reversing rod should operate freely, and its torsion spring should maintain the rod safely in either position.

The reversing latch spring links should be so adjusted that, with the reversing levers at rest

in their forward position, the reversing latches will clear the paths of the ribbon feed bell cranks by  $5/32''$  and the latches will engage the bell cranks when the reversing levers have moved  $1/2''$  from their rest stops.

The ribbon spool retaining springs should be so formed that the ribbon spools are held straight and do not bind or reel out too freely. IBM ribbon spools are held to close tolerances; however, some spools supplied by other vendors have been found to vary as much as  $1/32''$  in width. In order to compensate for these differences, ribbon retainer springs have been redesigned with a permanent form or set so as to maintain constant tension on spools of varying thickness.

Check the ribbon reversing action by hand and observe that the torsion spring on the ribbon reversing rod will complete the reversing action when the reversing mechanism has moved through approximately  $2/3$  of its prescribed travel.

Ribbon guides must be smooth and properly aligned to permit free movement of the ribbon. The ribbon lift connecting link should be so adjusted that it takes up all the play in the

linkage when the cam levers and lift bail are at rest, but does not push the ribbon lift lever up off its stop. Check by holding the ribbon lift lever against its stop and, with the bail against the cams, see that the link just meets the hole in the bottom end of the actuating lever. Observe that the toggle comes nearly into a straight line upon operation of a type bar by hand. In stencil position the toggle will pass its center slightly.

The vinylite stop should be shimmed so as to hold the lift lever high enough to prevent any movement of the center guide during shifting.

The ribbon lift guide clevis should be adjusted so that when the ribbon is at its lowest setting, the tops of the tallest characters strike  $1/32''$  below the upper edge of the ribbon. The upper, rear lug on the positioning plate should be formed so the underscore will strike  $1/32''$  above the lower edge of the ribbon. In the attainment of the setting, if it appears that other characters are made to track too high on the ribbon, such as tall letters showing black tops on red, the underscore cam hook may be peened as in Figure 128.

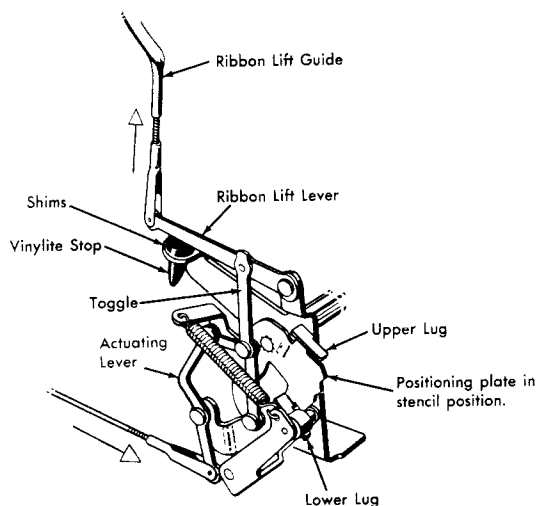


Figure 127. Ribbon Lift Mechanism

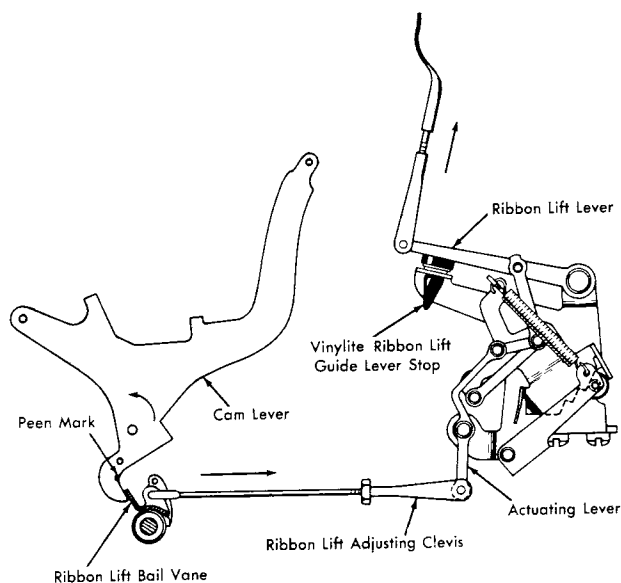


Figure 128. Peening Cam Lever to Prevent Ribbon Lifting too High

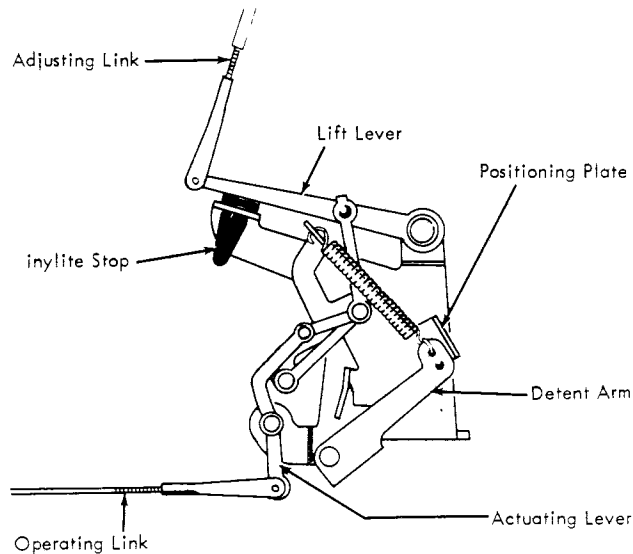


Figure 129. Adjustment to Prevent Light Impression in Red Ribbon Position

It might be observed that the underscore falls below the ribbon but other characters track properly. Peen only the underscore cam lever hook to prevent lifting the ribbon too high.

The color control button linkage shall be adjusted so that when the ribbon lift control button is in the so-called black ribbon position, the slope of the button will be parallel to the slope of the keyboard.

It may be observed that as the operating link moves toward the rear, the actuating lever goes counterclockwise (Figure 129). If the vinylite stop is quite low, the link from the top of the actuating lever to the center of the toggle will be too near to parallel with the lower link of the toggle. This will cause a cramping condition as the actuating lever starts its movement. After movement is under way this cramping condition will not be present, and the actuating lever will have a straighter, easier pull. However, the type bar impression for this stroke will be

lighter because the cramp in the ribbon lift will have reduced the velocity of the cam travel.

This condition, which may be noticeable only in the RED or high lift position may be corrected by shimming or forming the vinylite stop bracket upward slightly so as to raise the lift lever and tend to straighten the toggle to a point where the cramping will be relieved.

If it is found necessary to raise the vinylite stop by an appreciable amount to correct light impression in the upper position of the ribbon, type impression on stencil position may become light. This is due to the toggle linkage being held too tightly or too straight by the high position of the stop, which will tend to bind the mechanism. This condition may be relieved by forming the lower lug on the positioning plate toward the rear of the machine to allow the toggle a small amount of free motion in stencil position.

With other ribbon adjustments properly made, the ribbon should track properly in the black position. If the tracking in high lift or RED position does not coincide, then the upper lug on the positioning plate may have to be formed downward to prevent the ribbon from rising too high in RED position.

### Line Gage Card Holder

The line gage card holder may be adjusted vertically by loosening its mounting screws and

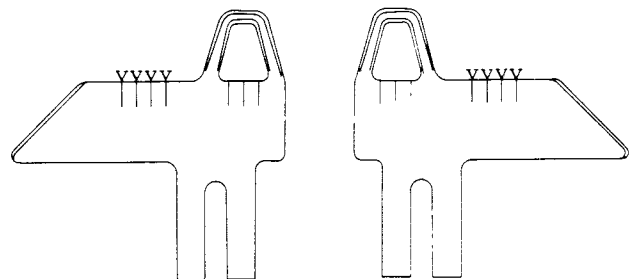


Figure 130. Line Gage Card Holder Adjustment

moving it up or down until the top edge of the gage is level with the bottom of the line of type. Horizontal adjustment may be made by shifting the entire front dust cover on its elongated mounting holes. Align the graduations with the typed V's (Figure 130).

#### Paper Scales Adjustment

There are two scales located in front of the platen. The top scale is graduated in inches, and the bottom one indicates the number of spaces on the line (Figure 131). The scales should read zero when the carriage is returned

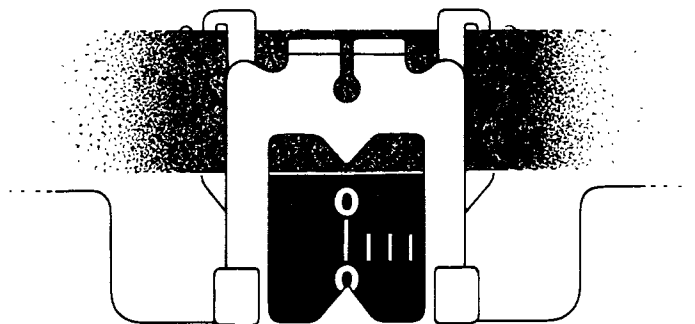
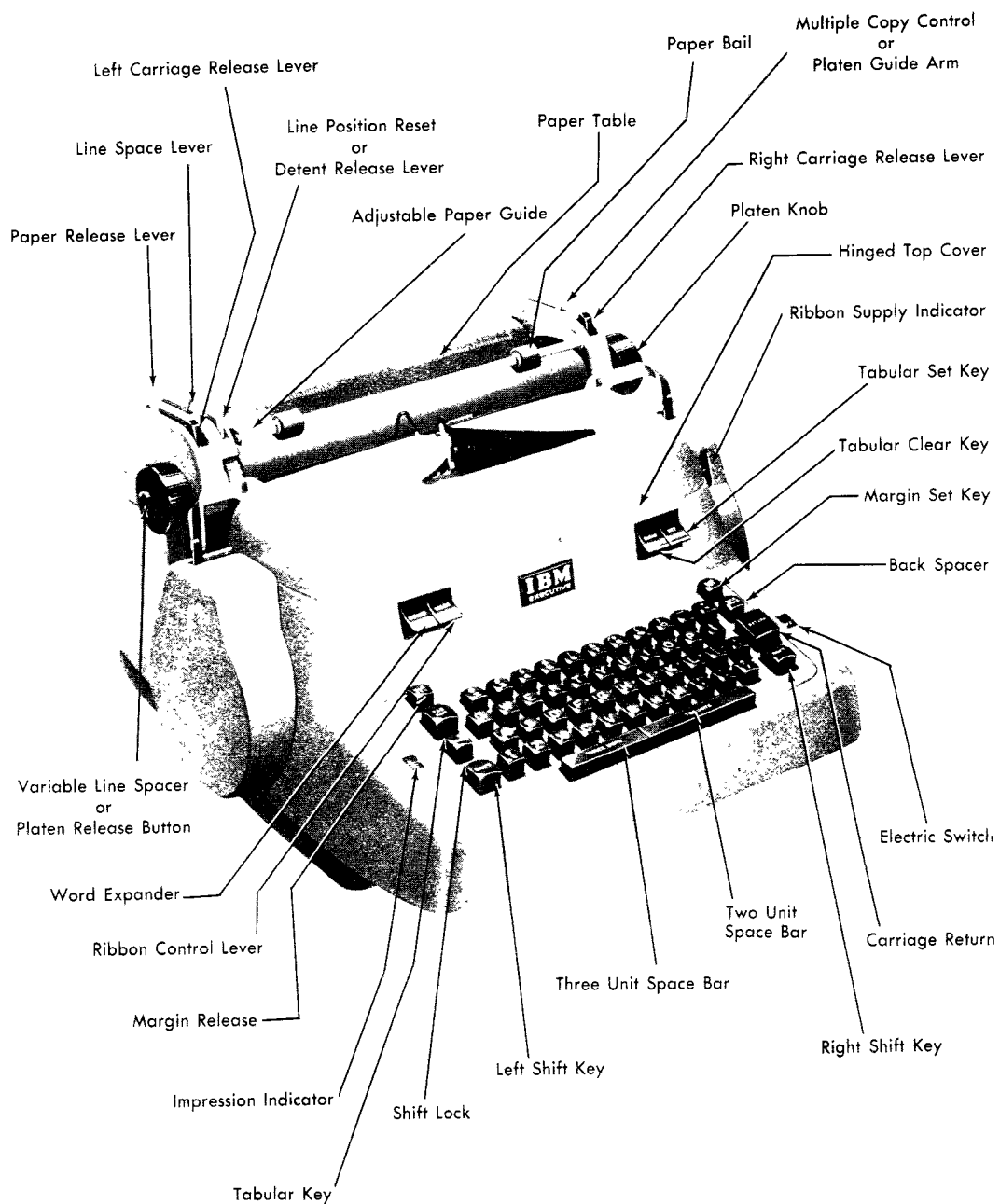


Figure 131. Front Paper Scales

to the left with the margin stop in its extreme left position.





Electric Executive Typewriter

## ELECTRIC EXECUTIVE TYPEWRITER

The IBM Electric Executive Typewriter features proportional spacing which enables each character to assume the space or width required to conform with accepted standards of type design.

Unlike the standard typewriter spacing, the proportional spacing system provides several different widths of letters or characters. The width taken by each character consists of two or more units. Any movement of the carriage must be measured in units. A unit measures either 1/32", or 1/36" or 1/45", depending on the pitch of the escapement mechanism in the machine. The least spacing used for any one character is two units, and the greatest is five. Spacing between words may be any desired number of units. The character spacing is illustrated in Figure 132, which compares proportional and standard spacing and shows how the distortion of narrow and wide letters is eliminated in using proportional spacing. Spacing for upper case and lower case letters or characters is not necessarily the same. The correct spacing for any character is entirely automatic in its selection and operation.

STANDARD SPACING		PROPORTIONAL SPACING		UNIT WIDTH
i	iiii	i	iiii	2 units
o	oooo	o	oooo	3 units
w	www	w	www	4 units
m	mmmm	m	mmmm	5 units

Figure 132. Relative Spacing, Proportional and Standard

### Standard Spacing

Notice the vertical lines formed by the white spaces between rows of characters indicated by the ruled lines.

### Proportional Spacing

Notice that in the proportionally typed page there are no vertical lines to distract the eye of the reader.

Figure 133. White Bars of Space between Letters

In standard spacing, the illusion of vertical lines is formed by the white space between characters. These white vertical bars offer resistance to easy scanning of a page of typed material and set up an impedance to fast reading (Figure 133).

Proportional spacing overcomes the illusion of these white vertical bars and renders the material easier to read and more attractive to the eye.

Saving of space results from the use of the proportional spacing principle. For example, IBM Proportional Bold Face type is slightly larger than Pica type but requires approximately 15 percent less space. Since proportional type can be photographically reduced and still have greater legibility than standard typewriter type, even greater saving of space is possible.

A figure 1 must be carried on the keyboard to balance with other figures. All figures space three units and the lower case letter l spaces only two units.

Figure 134. Justifying the Right-Hand Margin

Justification of the right-hand margin (Figure 134) - that is, preparing copy so that both

margins run even from top to bottom - may be accomplished on the Executive machine by typing twice through the copy. The first time through, all line ends are measured to a common right-hand margin; the second time through, spacing is manipulated to add or subtract units and even up the margin. Details of this method of justification are given on page 125.

Figure 134 also explains the necessity for a figure 1 on the keyboard.

## MECHANICAL PRINCIPLES OF THE ELECTRIC EXECUTIVE TYPEWRITER

### Principles Common to the Standard Model

Several features of the Electric Executive typewriter are common to the Standard model and will not be repeated in this section. These features include:

Motor	Margin Set
Belt Drive	Repeating Cams
Power Roll	Type Guide
Key Levers	Shift Mechanism
Key Buttons	Paper Feed
Margin Release	Clutch Pulley Spring
	Cloth Ribbon Feed

Principles that differ from those of the Standard model will be discussed in the order of their operation.

### Escapement Selectors

The Executive Typewriter operates with a standard key lever, cam and type bar arrangement. The escapement mechanism is designed to permit selection of the proper carriage travel for any width of type character. In order to select the proper escapement, a stud has been riveted to the letter cam lever just in front of the cam and a selector bar is hooked on to the stud (Figure 135).

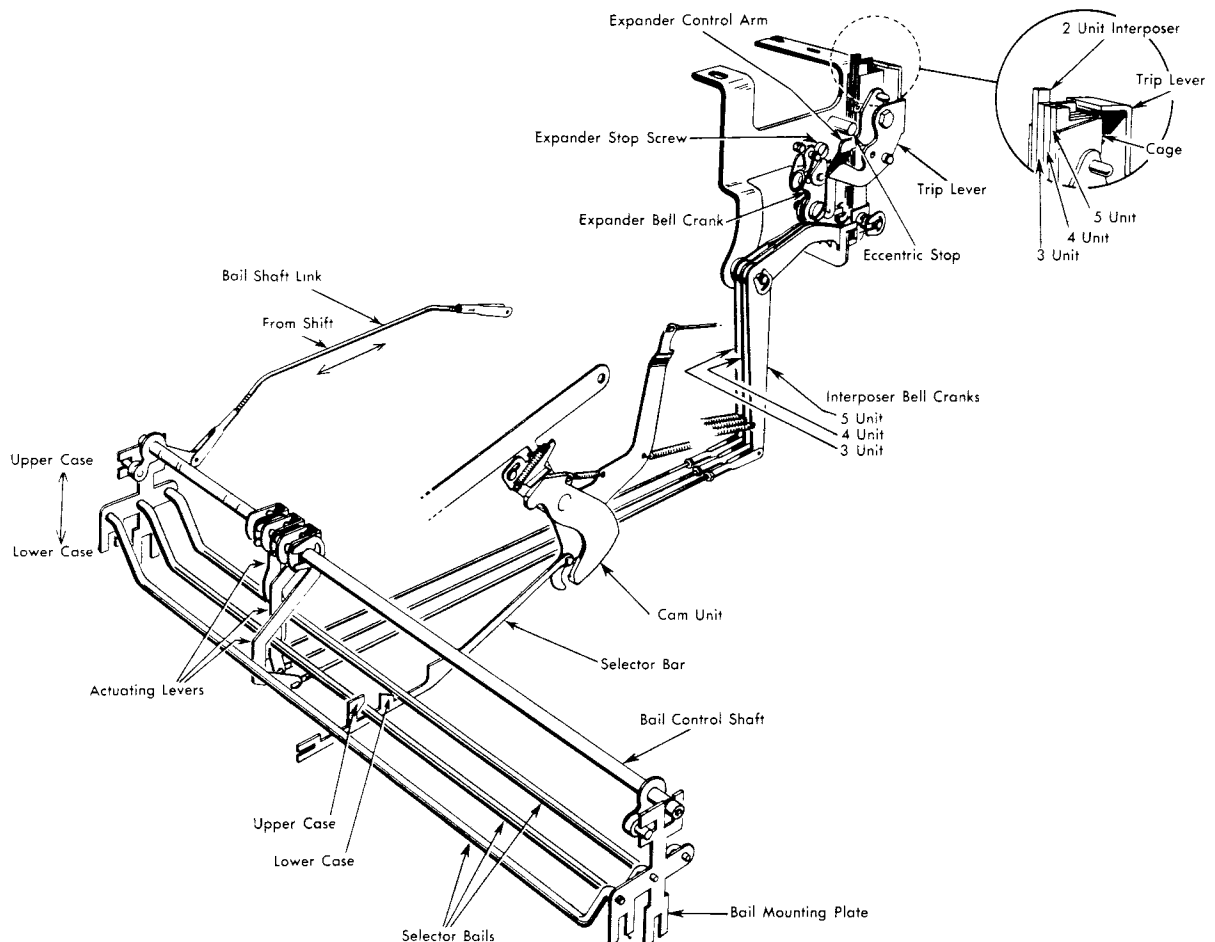


Figure 135. Escapement Selector Mechanism

The purpose of the selector bar is to follow the motion of the cam lever toward the rear of the machine and to pull a selector bail in the same direction. The design of the selector bar determines the amount of carriage travel allotted for each type face by selecting the proper bail and interposer. The bails are shifted up or down by the bail shaft link extending from the left end of the bail control shaft back to the extension on the left-hand shift toggle shaft bell crank.

As the type basket is shifted into the upper case position, the selector bails are moved into the upper position. Thus, if a selector bar bears a full lug, it will select the same escapement in both upper and lower case typing (Figure 136). If the bar is cut with a lower half lug in one place and an upper half lug in another place, the bar will change its selection upon shifting (Figure 136).

As a selector bail moves toward the rear, it bears against an actuating lever and causes it to push a link, at the rear end of which is attached an interposer bell crank.

An interposer bell crank raises an interposer to a height where it will be struck by the top,

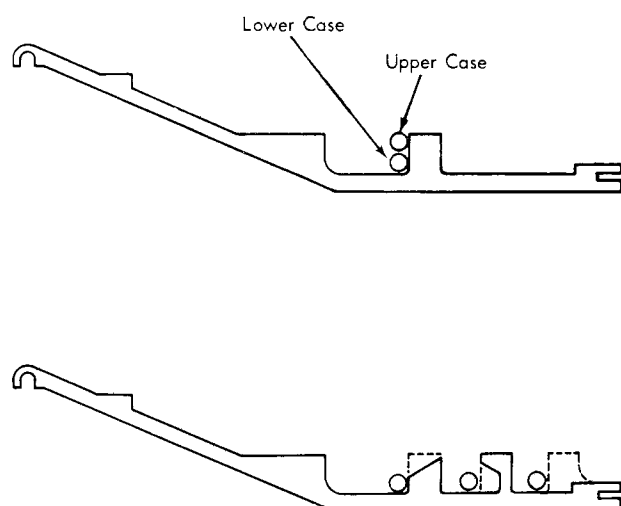


Figure 136. Selector Bars

or blade, of the escapement trip lever (inset, Figure 135).

At the time that an interposer reaches a position in front of the top part or blade of the trip lever, the type bar pushes on the universal bar. On the left end of the universal bar there is attached an escapement trip link, running to the bottom of the trip lever. The motion of the type bar is thus transmitted to the trip lever, causing the top of the trip lever to push forward on any interposer that may have been raised by the selector mechanism.

### Expander

The expander bell crank is operated by a link running from the hand button on the front cover and is maintained in either the expanded or normal position by a hairpin spring. For normal operation the interposer cage is held to the left by the expander control stud which rests against an inclined block. In this position the escape-

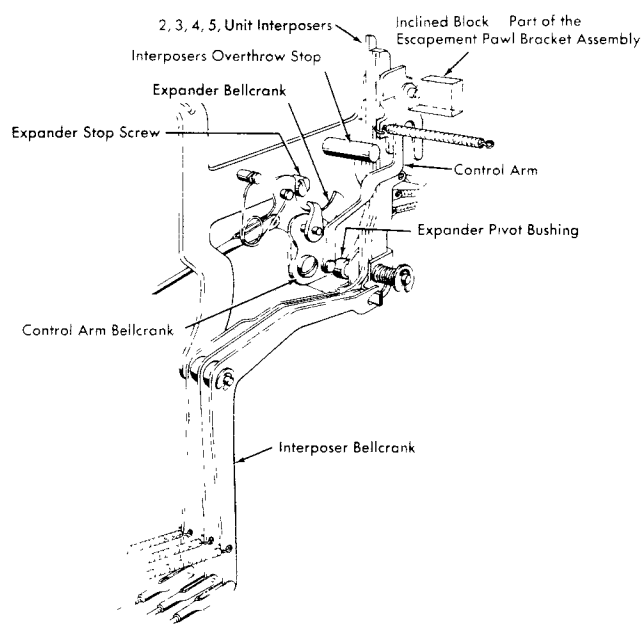


Figure 137. Expander Mechanism

ment may be operated by the two-unit interposer or the three, four or five-unit selective interposer.

When the expander is operated to the expanded position, the control stud rides up the inclined block. The top of the interposer cage, under tension of a spring, follows the stud to the right so that its expanded position is one unit farther to the right than normal. At the same time, the bottom of the cage is cammed to the right by an offset, formed in the bottom of the expander bell crank. The shifting of the interposer cage causes each of the interposers to trip one extra pawl; thus, their individual value becomes three units for the two-unit interposer and four, five and six units, respectively, for the three, four and five-unit selective interposers (Figure 137).

### Escapement

The escapement mechanism contains eight escapement pawls, varying in the length of their tips by one unit of space. The escapement rack teeth are spaced eight units apart, and when a tooth rests on the pawl tips, the pawls are pushed on elongated holes so that the tails of the pawls project by varying distances into the path of the selector interposers. Each of the interposers is one unit thick (Figure 138).

Since the tails of some of the pawls project in front of the interposers, and the interposers are

operated by the trip lever, the pawls are then tripped out of the escapement rack according to the number of the interposer that has been selected. For example, when one of the escapement rack teeth is at rest in such a position as to push the tails of any three pawls in front of the three-unit interposer, then if the three-unit interposer is selected to rise in front of the escapement trip lever, the three pawls thus positioned will be removed from the rack and the carriage will travel three units to the left under tension of the main spring.

The two-unit interposer, operated on every tripping operation, trips two pawls whenever the trip lever is actuated. Other interposers then have a value of three units, four units and five units, respectively, from left to right, reading from the front of the machine. The number of spaces that the carriage travels depends on the number of pawls that are tripped. As soon as a pawl is tripped, it is pulled to the right by a spring attached to the back of the pawl. Because, compared to the carriage assembly, the pawl is a small, light part, it snaps into position and comes to rest in its new place on the escapement rack before the carriage actually gets under way to move to the left. This action has been shown in slow-motion moving picture studies of the escapement.

### Space Bars

The two-unit space bar mechanism, through the space bar cam, link and lever, operates the escapement trip lever and the two-unit interposer to trip two escapement pawls and cause the carriage to travel two spaces to the left (Figure 139).

The three-unit space bar is designed to select a three-unit interposer and thus secure a three-unit escapement from the operation of the space bar cam.

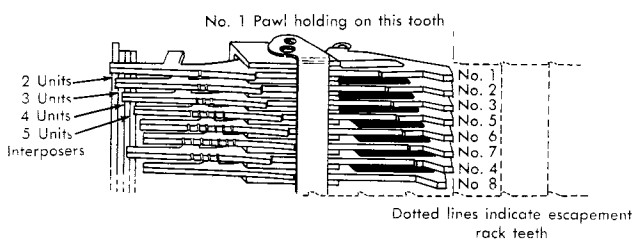


Figure 138. Escapement Pawl Assembly

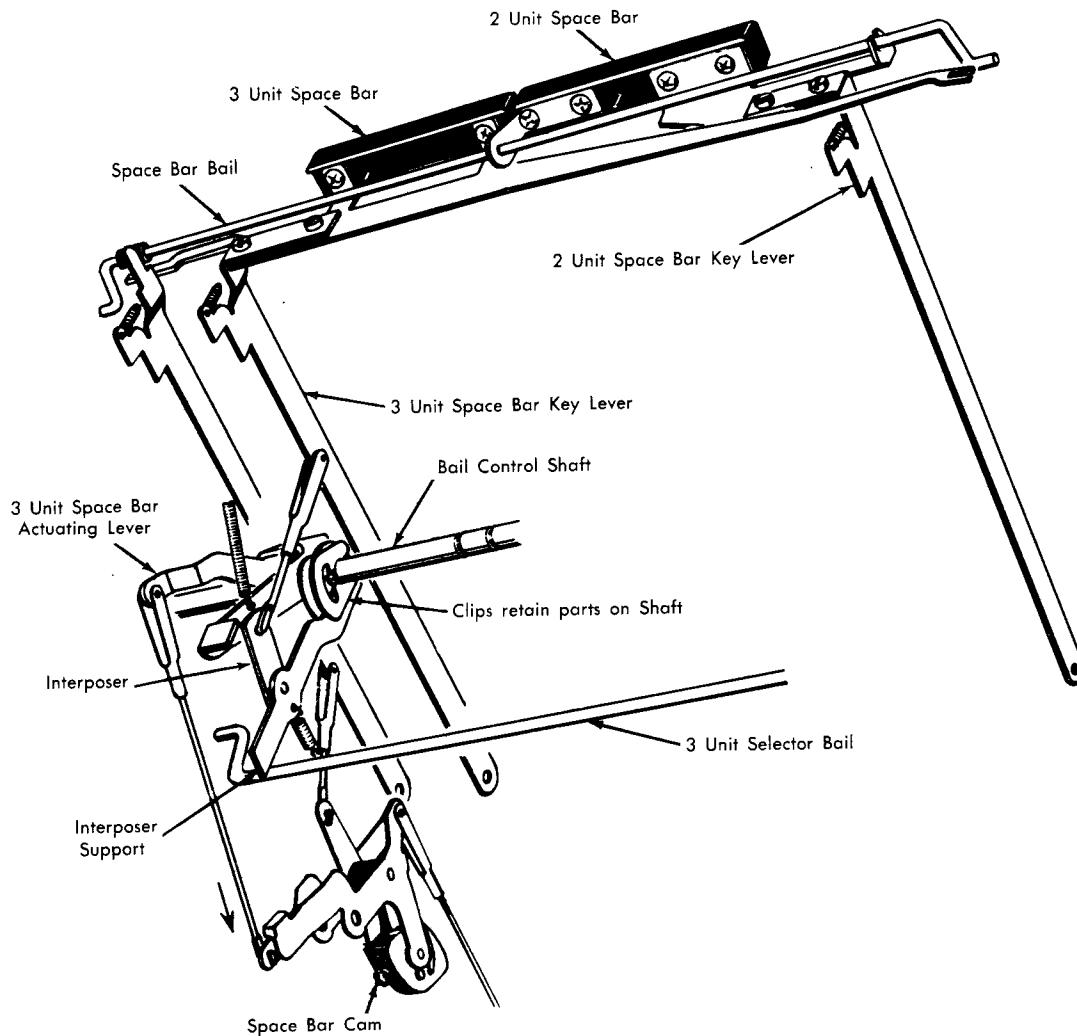


Figure 139. Space Bars

From the illustration of the interposer and escapement pawl relationship (Figure 138), it may be observed that if both space bars are depressed simultaneously, a three-unit escapement would result.

If the expander is operated to the expanded position when the space bars are operated, each space bar will increase one unit in value.

### Back Space

Observation of the back space mechanism may be made by tilting the machine backward and

operating the power roll by hand. Trip the back space key lever before each tested operation.

Operation of the back space cam causes the back space bell crank, under the right end of the rear rail, to rotate clockwise and to pull the back space pawl link to the right. The back space pawl support, carrying the four back space pawls, is thus moved to the right.

A stud, mounted on an adjustable bracket, acts as a back space pawl guide to position one of the four pawls against an escapement rack tooth. A small tension spring attached to each pawl maintains pressure of the pawls toward the rack.

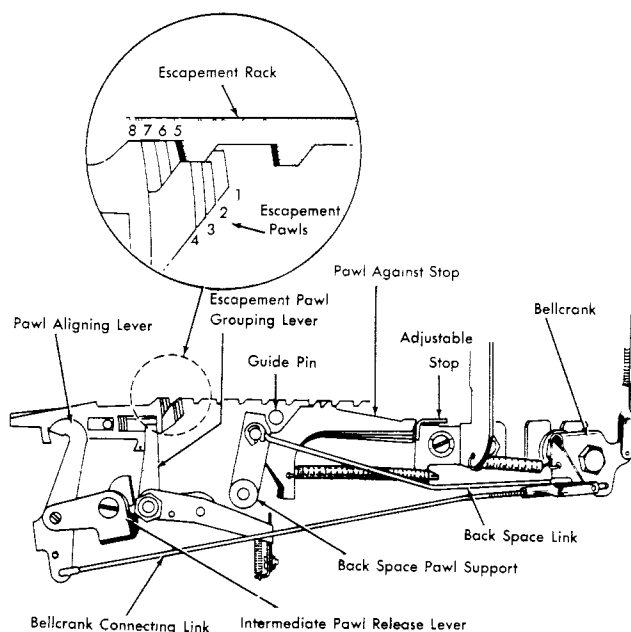


Figure 140. Back Space, Cam on High Point

The pawls are each cut with two teeth and are arranged so that a rack tooth may be caught by the pawls in any one of eight positions. In this manner, the back space pawl that is permitted to engage the rack assumes a deeper position than the other three pawls (Figure 140).

It is essential that the escapement rack tooth which is engaged by an escapement pawl at the time of a back space operation, be moved only to the next escapement pawl; therefore, a second link from the back space bell crank is attached to the pawl aligning lever, thus affording a means of taking up the slack of the escapement pawls so that the back space pawl will move the escapement rack tooth to the next escapement pawl.

When the back space bell crank is rotated, the back space link begins to move immediately. As soon as the back space pawls are moving, the second link, called the back space bell crank connecting link, which is mounted in an elongated hole in the bell crank, then moves so as to pull the pawl aligning lever and slide the

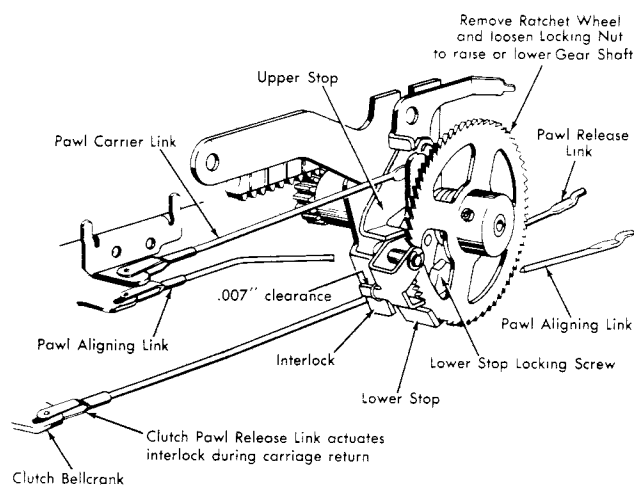


Figure 141. Rotary Back Space Mechanism

escapement pawls to the left, thus arranging them so that a pawl will be next to the escapement rack tooth. This design permits the rack tooth to catch the next nearest escapement pawl when the rack is moved by the back space mechanism.

### Rotary Back Space

The rotary back space mechanism, used on Executive machines with 1/45 pitch escapement, utilizes a pawl and ratchet principle.

Gear teeth, cut in the bottom of the escapement rack engage a pinion gear. On the same shaft that supports the pinion, a ratchet wheel is assembled, and a pawl - taking motion from the back space cam - rotates the ratchet one tooth at a time. While the carriage is being moved one unit backward, a link from the back space bell crank to the pawl aligning lever is operated so as to pull the escapement pawls into line and to permit the last previous escapement pawl to drop into the rack just as the back space pawl reaches its stop. The necessary interlock is provided by a lever which prevents the back space pawl from engaging the ratchet during any operation of carriage return, tabulation or carriage release.

### Grouping Mechanism

During the operations of carriage release, tabulation, and carriage return, it is required that the escapement pawls be removed from the escapement rack to facilitate free movement of the carriage. Provision for such release is made by a pawl release lever, attached to the top of the rear rail. The pawl release lever is designed with an upright lug on its front side which lies in the path of the carriage universal bar and may be actuated whenever the carriage universal bar is moved by either of the two carriage release levers. An upright lug on the rear side of the pawl release lever is actuated by the tabular lever upon tabulation, and an extra lever, operated by the clutch lever upon latching, turns the pawl release lever to take the escapement pawls out of the rack by means of the pawl aligning lever.

A lug of the pawl release lever projecting downward and lying against the back of the rear rail, actuates the intermediate pawl release lever, which, in turn, operates the pawl aligning lever in order to push the tails of all pawls forward. The tips of the pawls are thus removed from the rack, and the carriage is free from the escapement mechanism.

It may be noted that the pawl aligning lever moves toward the rack during pawl release

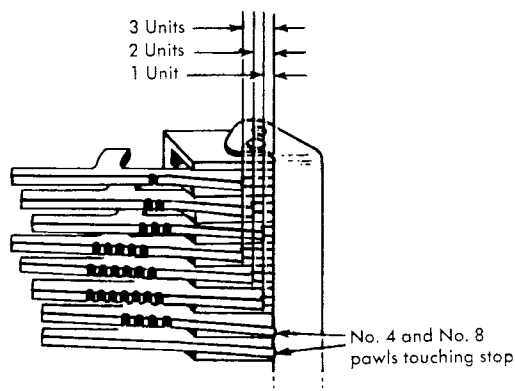


Figure 142. Pawls Grouped

operations and that it moves the pawls along the rail toward the left during back space operations. The two motions are entirely unrelated.

The escapement pawls are arranged into two groups of four pawls each during any pawl release operation and are latched in that arrangement (Figure 142), until the operation is completed and the pawls are restored into the rack. The tabular rack, margin rack, and the space scale on the front paper guide are designed with four-unit graduations in order to complete the four-unit system. Upon restoring, the unlatching pawl unlatches the grouping mechanism, and the escapement pawls resume their normal arrangement. The above procedure provides a greater degree of accuracy during tabulation and carriage return than might otherwise be obtained. A detailed description of the grouping mechanism follows.

The pawl release lever moves the intermediate pawl release lever to the rear, causing the pawl aligning lever to move forward and carry with it the forward arm of the intermediate grouping lever. The formed shoulder that constitutes the right-hand member of the intermediate grouping lever bears against the grouping lever and causes the grouping lever itself to move to the left. The forward arm of the grouping lever is a bail which reaches up through holes in the pawls and moves the 1 and 5 pawls three units to the left while moving the 2 and 6 pawls two units to the left. The 3 and 7 pawls will each be moved one unit to the left. This movement lines the pawls up in such a manner that pawls 1, 2, 3 and 4 are in one position, and pawls 5, 6, 7 and 8 are in another position four units farther to the left, thus permitting an escapement rack tooth to be engaged by either the 1 or the 5 pawl. At this point the escapement may be regarded as having only two pawls.

The rear arm of the intermediate grouping lever moves to the left and permits a latch to

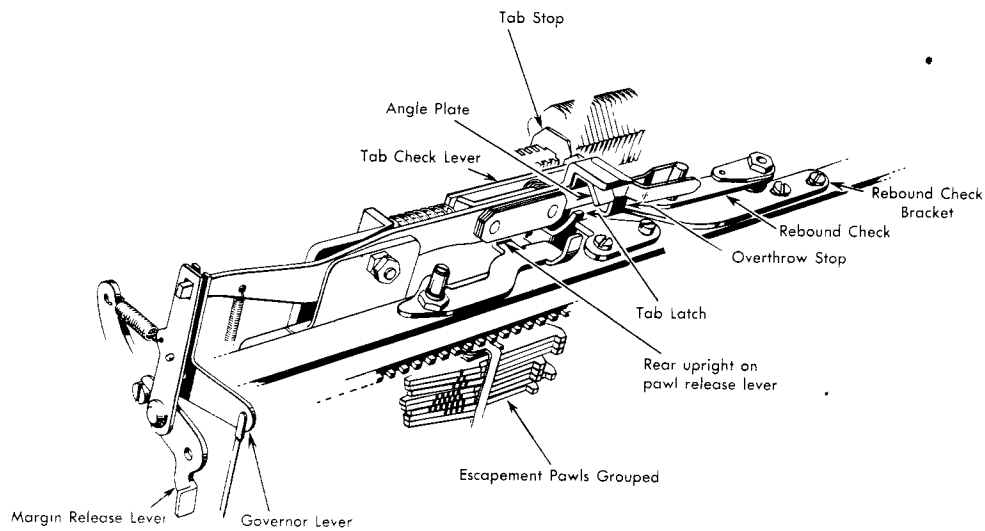


Figure 143. Executive Tabular Mechanism

spring into place, holding the grouping arrangement of the pawls until the latch is released by the unlatching action of the 4 or 8 pawl.

The 4 and 8 pawls are below the other escapement pawls. Upon being moved to the left by a tooth of the rack, the 4 or 8 pawl carries with it the unlatching lever. As the front end of the unlatching lever moves to the left, the rear end pulls the latch to the right, releasing the intermediate grouping lever, and the grouping lever restores, thus permitting the escapement pawls to resume their normal arrangement after entering the rack.

#### Tabulation

On the Executive typewriter, tab stops are placed four units apart on the rack. The operator may tabulate to every other stop which is comparable to the action of the standard machine.

When the tab lever is pulled out, it engages the rear upright lug on the pawl release lever (Figure 143) and causes the escapement pawls to be pulled out of the rack. The latch (Figure 144) springs into place and holds the tab lever in the

operating position with the tab check lever in position to be caught by the first set tab stop.

A compression spring behind the tab check lever absorbs the motion if the tab lever is operated when the carriage rests in such a position that the tab check lever strikes into a set tab stop upon operation.

With the escapement pawls effectively latched out of the rack, the free carriage travels to the left, under tension of the main spring, until a tab stop strikes the tab check lever, causing it to unlatch and restore all parts to their normal position.

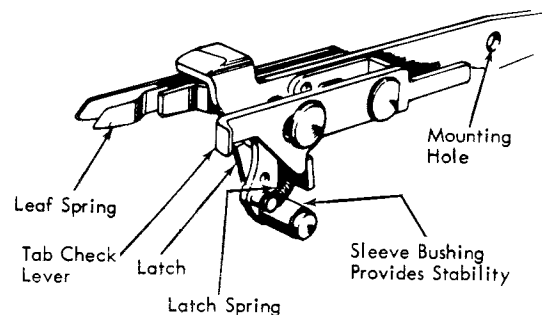


Figure 144. Tab Latch and Check Lever

A rebound check lever momentarily backs up the tab stop to prevent the carriage from bouncing back to the right at the time the tab stop meets the tab check lever. The leaf spring, used to return the rebound check lever to rest, has purposely been designed light to permit the rebound check to remain engaged as late as possible (Figure 144).

#### Carriage Return

In addition to the operations of returning the carriage and holding the escapement pawls out of the escapement rack, as the standard mechanism does, the Executive carriage return mechanism must also group the escapement pawls. The purpose of this operation is to provide a better opportunity for the escapement pawls to re-enter the escapement rack. By grouping the eight pawls in two groups of four pawls each, the pawls restore to the rack at the conclusion of an operation in such a manner that the carriage will rest on either the 1 or the 5 pawl (Figure 142).

#### Carbon Ribbon Feed

The Executive machine may be used with a cloth ribbon, but a carbon ribbon is most generally used because it provides a more sharply detailed impression with clearer outline.

The carbon ribbon feed, which incorporates a ratchet and pawl principle, is driven by the left-hand ribbon feed operating link to turn a geared feed pulley and feed a given amount of ribbon to a take-up spool. The take-up spool is driven by a pulley attached to the left-hand side of the power roll driven pulley.

#### Type Styles

The many different applications of the Executive machine require different styles of type. Eight different type faces are illustrated with a general

note on the application for which each may be recommended. Exceptions to these recommendations will depend upon the individual preference of the customer.

#### Illustrations of Type Styles

**BOLD FACE** - - - - - This is a sample of IBM Bold Face type prepared on the IBM Electric Executive typewriter. Bold Face type lends itself to preparation of masters for reproduction by nearly all processes except stencils.

**SECRETARIAL** - - - - - This is a sample of 12 point Secretarial type prepared on the IBM Electric Executive typewriter. Secretarial type is adapted to correspondence work. Because of its fine line it is sometimes preferred to other types.

**MODERN** - - - - - This is a sample of 10 point Modern type prepared on the IBM Electric Executive typewriter. Modern type is adaptable to correspondence work.

**DOCUMENTARY** - - - This is a sample of 11 point Documentary type prepared on the IBM Electric Executive typewriter. Documentary type is adapted to correspondence work.

**COPPERPLATE GOTHIC** - - - - - THIS IS A SAMPLE OF COPPERPLATE GOTHIC TYPE PREPARED ON THE IBM ELECTRIC EXECUTIVE TYPEWRITER. UPPER CASE IS 12 POINT AND LOWER CASE IS 6 POINT. THESE TWO SIZES OF TYPE ON ONE MACHINE ADAPT IT FOR PREPARING PHOTOGRAPHIC MASTER COPY FOR FORMS HEADINGS HOUSE ORGANS AND ADVERTISING MATERIAL.

**TEXT** - - - - - This is a sample of 8 point Text type prepared on the IBM Electric Executive typewriter. Text type is ideal for preparation of body copy for booklets, house organs and other publications. It also provides distinctive looking executive correspondence.

MID-CENTURY - - - - - This is a sample of 12 point Mid-Century type prepared on the IBM Electric Executive typewriter. Mid-Century type is modern and functional in design, making it adaptable to correspondence as well as the preparation of master copy for booklets, brochures and other publications.

CHARTER - - - - - This is a sample of 8 point Charter type prepared on the IBM Electric Executive typewriter. Charter type closely resembles Text type and lends itself to the same applications.

## Cloth Ribbon

## Platen

PO No.16	IBM Bold Face Type	8
PS No.26	IBM Secretarial Type	2
PM No.32	IBM Modern Type	8
PE No.40	IBM Documentary Type	8
PG No.46	IBM Copperplate Gothic Type	8
PH No.47	IBM Text Type	2
PF No.50	IBM Mid-Century Type	8
PR No.51	IBM Charter Type	2

## Carbon Ribbon

## Platens

In selecting a platen for a particular application, one general recommendation should be followed. Bolder face types will require harder platens. This is explained by the fact that, if the type is permitted to bury its face into the cushion of a soft platen, the paper will begin to wrap around the typeface and will thus lose the sharpness of its outline. A softer platen will often result in a bolder type impression which may have definite appeal to some customers, but it will lack the definition and sharpness that a harder platen will provide.

The hardness of the platen, indicated by the number on the right-hand end of the rubber, will also depend on whether a cloth or carbon ribbon is to be used. The following information should assist in selecting the proper platen:

PO No.16	IBM Bold Face Type	8
PS No.26	IBM Secretarial Type	1
PM No.32	IBM Modern Type	2
PE No.40	IBM Documentary Type	2
PG No.46	IBM Copperplate Gothic Type	2
PH No.47	IBM Text Type	1 or 2
PF No.50	IBM Mid-Century Type	2 or 8
PR No.51	IBM Charter Type	1 or 2

The platen should be as hard as can practically be used and not cause excessive embossing. Embossing to a minor degree will be expected, but when it is so strong as to cause cutting of ribbons and originals, then steps should be taken to stop it. When embossing shows on only a few characters, it may be because of too heavy impression adjustment or too sharp type faces. These should be investigated before changing to a softer platen.

## REMOVAL AND ADJUSTMENT PROCEDURES FOR THE ELECTRIC EXECUTIVE TYPEWRITER

### Carriage and Rails Assembly

A routine for removing the carriage and rails assembly has been developed to save time in this operation.

Remove the three interposer bell crank links and their springs.

Remove the small guide comb that guides the bottoms of the interposer bell cranks and to which the three springs were attached.

Disconnect the tab governor pawl link.

Remove the screws from the rear cover section. It will not be necessary to remove the front cover. This should complete the work on the bottom of the machine for the time being.

Facing the back of the machine, disconnect the tab operating link, the expander link and the trip link and spring. Locate the back space operating link which runs from the cam and disconnect it where it attaches to the back space bell crank on the rear rail. Leave the other back space links connected. All clevises may be taped to hold their adjustment.

Disconnect both clutch links that belong to the carriage. Leave the side clutch links connected. Remove the margin set bracket assembly.

Remove the dust cover from the front rail.

Disconnect the carriage tension tape from the escapement rack and slowly let the carriage

tension spring take it up until the end clip of the tape is caught by the small idler pulley where it will be held. This can be done with the aid of a spring hook.

Disconnect the carriage return tape from the carriage and allow it to be drawn back as far as its idler pulley. Push the clip down between the idler and the side frame so that it will be out of the way.

Remove the four rail screws and run the carriage all the way to the right side of the machine so that the interposer bell cranks will be visible from the top. Lift the carriage off, being careful of the tab operating link and the connection on the universal bar which normally holds the trip link. By twisting the carriage around slightly to the right, it should lift out. Raise the escapement end of the assembly to an upright position so as not to lose the clutch links. Set the assembly upside down so that it rests on three points - the detent release lever, the paper release lever and the multiple copy lever, or platen guide arm. This will prevent its resting on the carriage release levers so as to cause the pawls to stay out of the rack.

All adjustments concerning the proper operation of the escapement, pawl release, grouping and back space, may be checked by hand operation. The rail supports may be adjusted and all parts lubricated with porpoise oil prior to re-assembly.

Check the tab governor pawl link, the escapement trip link and spring, the knockout link and the pawl release link.

While installing the carriage, hold it with the escapement end upward, the carriage extended downward from the rails and, still working from behind the machine, hold the two clutch links with the left hand and guide them so that the longer link goes under the tab set and clear links but over the bell support bracket. The other clutch link, called the pawl release link, should go over the tab set and clear links as well as over the bell bracket. Guide the tab operating link carefully into place and install all rail shims. These shims are necessary on proportional spacing machines in order to lift the carriage up higher than on standard machines. This has been done because Executive type slugs are soldered higher on the bar than on standard machines so that the wider characters can fan out better in the basket.

When tightening the front rail screws, press the front rail forward tightly against the frame. Tighten the rear rail screws, check the carriage fit, and draw the rear rail adjusting screws up to a snug setting.

Connect the two tapes. Connect the tab operating link and the tab governor link. Rotate the power roll slowly by hand to see that the tip of the tab check lever is carried to within  $1/32$ " of the tab rack. Hold the carriage while this is being done.

Connect the triplink and check the tripping point with three type bars to see that it is even. Observe the tripping point for both upper and lower case of any given type bar. If the lower case trips earlier, then form the universal bar connection upward. Connect the triplink spring. Check the interposer overthrow stop and see that it is properly adjusted; also, that it does not interfere with the movement of the expander bell crank.

By observing the carriage return tape hook

lever, with the type basket in its upper position, see that no interference can exist between the type universal bar and the hook lever. If necessary, form the bottom of the hook lever back so as to be out of the way when the universal bar operates.

Connect the upper, or pawl release link for the clutch and adjust it so that when the clutch is locked, the escapement pawls will be held out of the rack by  $1/64$ ".

See that the clutch knockout lever tip is so formed that the working surface of the knockout lever just clears the undersurface of the margin rack by  $1/32$ ". Adjust the margin rack.

Adjust the knockout link and connect it to the lower clutch bell crank so that when the knockout lever is as high as it can go, the clutch latch will hold the clutch operating lever by the thickness of its own metal.

Connect the back space link to the bell crank on the rear rail and adjust it so the spring lugs on the backs of the back space pawls rest  $1/32$ " away from the stud of the back space pawl support. If this does not give sufficient motion to the back space action, then shorten the back space link, from the cam, until it does.

Check the power roll speed, which should be 95 feet per minute,  $+2-0$ , for machines equipped with modified cam knockout. This includes most Executives.

Adjust the platen to proper ring and cylinder. Place a single sheet of paper in the machine and check for alignment of type, type bars entering the guide properly, and the proper ring and cylinder adjustment of each type bar. Install the dust cover and adjust it so the line gage and card holder are aligned. Install the margin set bracket.

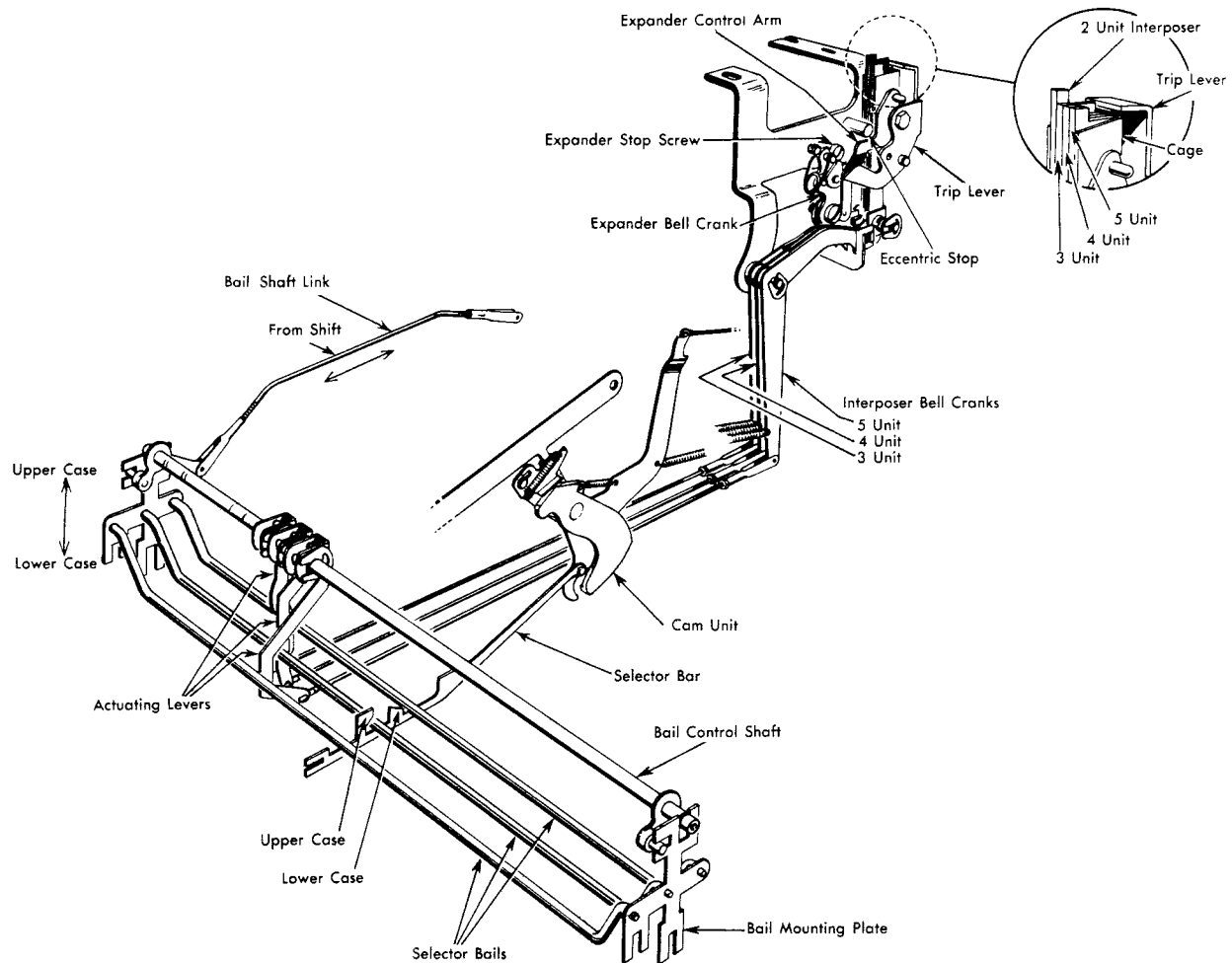


Figure 145. Escapement Selectors

Check upper and lower case type for motion and for striking evenly on top and bottom of all characters. Place a form in the machine consisting of one original and two carbon copies. Set the impression control at three, multiple copy lever or platen guide arms at zero, and strike up all characters in both upper and lower case.

Adjust the impression control screws until all type will print black and solid but with no cutting through on the original.

#### Cam Lever Bearing Support

The cam lever bearing support may be removed

by following the procedure outlined for the standard machine with some provision for the selector bars. The selector bars may be removed and marked with the position number which each one occupies.

#### Escapement Selectors

Selector bars may be removed by sliding the front selector bar support toward the front of the machine and, by raising the proper type bar, the front end of the selector bar will drop down. It will be necessary to remove the front case and drop the cam lever assembly in order to unhook the selector bar completely. The cam lever assembly may be dropped by pushing the fulcrum

rod out with another rod and separating the two rods at the point where the cam lever assembly is supported.

The interposer cage may be removed by disconnecting the interposer bell crank links, lifting the carriage and rails assembly, and removing the left-hand rail support. If it becomes necessary to remove the interposers from the cage, due care must be used to prevent loss or displacement of the small spacing washers used in this assembly.

In replacing individual interposers it should be borne in mind that escapements of different pitch require interposers of different thickness, except that the two unit interposer is always 1/32" thick. The three, four, five-unit interposers are each 1/32" or 1/36" or 1/45" thick, depending upon what pitch the escapement is. This difference indicates that there are also three different interposer cages as well. Since the differences are of such a minute nature, identification marks have been placed on these parts, as well as on the back space pawls, the pawl stop, and on the line gage card holder.

The pitch identification will be as follows:

1/32" Escapement	No Marking
1/36" Escapement	△
1/45" Escapement	□

The expander bell crank for the 1/45 pitch escapement differs from that for the 1/32 and 1/36 pitch escapement and is marked with a □.

The expander bell crank stop screw differs with each different pitch of escapement.

Escapement Pitch	Approximate Diameter
1/32	11/64"
1/36	7/32"
1/45	17/64"

It may be observed that the largest stop screw is used on the machine with the smallest escapement. This is necessary to limit the expander motion to the narrowest space.

Adjustment of the selector mechanism may be accomplished in the following sequence.

Observe that the shift motion is properly adjusted, then adjust the bail shaft link so as to move the bail mounting plates to their upper limits without choking off against the bail control shaft (Figure 145).

The selector bar support mounting plates may be adjusted up or down, if necessary, so that the bails just clear the selector bars with the bails in the lower case position.

The selector bar guide comb is to be adjusted, at its mounting screws, so that the limits of its slots will not interfere with the full, free travel of the selector bars.

The interposer bell crank guide bracket is mounted on elongated holes and is to be adjusted up or down so that the three selective interposers rest .025" to .030" below the path of the tripping blade on the top of the trip lever. This adjustment may be easily checked by holding the trip lever in the operated position with a type bar against the platen and observing the amount of forward and back movement on the bottom end of each interposer bell crank. The movement at that point should equal approximately .050".

The interposer connecting links are to be adjusted so that the following test will be successful. Hold a left-hand, three-unit type bar about half way up to the platen and operate the letter i key repeatedly. Gradually bring the three-unit type bar closer to the platen. The spacing of the letter i should increase from two units to three units as the three-unit type bar reaches

a point somewhere between one-half and two-thirds of the distance from the type rest to the platen.

The test may be repeated to check the center link by holding the w type bar, lower case, about halfway up to the platen and, by again operating the letter i key, determine the proper adjustment according to the foregoing procedure. Test the right-hand interposer link in the same manner, by operating the I key and holding the upper case W toward the platen.

When replacing the power roll, care must be exercised in replacing the three interposer bell crank springs. The left-hand spring, attached to the three-unit interposer bell crank, is shorter and has greater tension than the other two. Spacing errors could result if the springs were mutilated or misplaced.

It is essential that all selector bars impart equal motion to the selector bails. The point of contact between all bars and bails, in both upper and lower case, must be carefully checked and, where differences exist, the selector bars must be formed up to open, or down to close, the clearance. The forming can be accomplished with a pair of long-nosed pliers applied at the "neck" of the selector bar.

The clearance between the pawl ends and the interposers, at rest, should be adjusted by

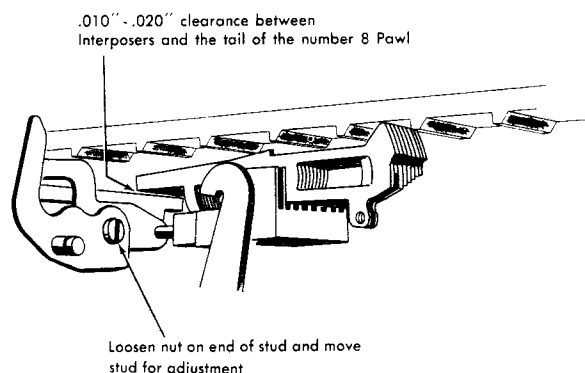


Figure 146. Pawl and Interposer Clearance

moving the trip lever stud forward or backward in its elongated hole until .010" to .020" clearance can be seen between the rear edge of the No. 8 pawl and the operating edges of the interposers (Figure 146).

Adjust the trip link so that the escapement trips when the type face is 1/4" to 3/8" from the platen. The universal bar should have been previously adjusted to permit an equal tripping point for left, center and right type bars. The trip lever should not move into tripping position too early so as to prevent an interposer from rising. Such a condition might be created if the trip link is too long.

Check the tripping point in both the upper and lower case and form the lug that carries the trip link on the universal bar to compensate for any difference. Form the lug down if the upper case tripping point is too early.

Adjust the eccentric stud that serves as an overthrow stop for the interposers so that any overthrow of the interposers will be stopped. Adjustment should be made by holding a type bar against the platen and bringing the eccentric stud against the interposers. Test several type bars to see that none is stopped before reaching the platen (Figure 147). A fault of this kind in making the above adjustment would result in light impression for the type bars affected.

To insure proper functioning of the escapement, the escapement trip lever stud must present a

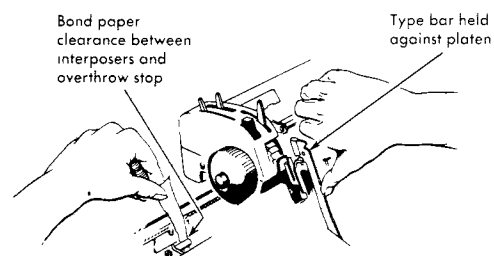


Figure 147. Testing Interposer Clearance

smooth surface to the interposers as they restore to their rest position. If the trip lever stud has become rough and rippled, partial piling can result because the interposers may be prevented from completely restoring after each escapement.

The proper repair is to replace the stud, although temporary relief may be obtained by turning the stud over to present a new surface to the interposer.

The bracket which carries the small interposer springs is formed at a right angle. If the interposers should tend to hang up and cause piling of type, the angle of the bracket may be increased to pull the springs  $1/8$ " farther toward the rear. Lubricant should be applied to the interposers first to insure that they are not sticking.

Fast, accurate operation of the escapement pawls and selecting interposers requires the use of a special lubricant.

The initial lubrication at the factory provides the proper amount of graphite in suspension for the surfaces of the pawls and interposers. There is no need for further application of this material, except when new parts are installed. It is recommended that such new parts be lightly treated with fine powdered graphite and then assembled and lubricated with porpoise oil. Re-lubrication should be continued with IBM No. 6 oil.

#### Expander

The expander control is mounted on the left-hand rail support by means of a screw. Removal of the screw permits removal of the expander control, after the link and hairpin spring are disconnected.

The expander cam for the  $1/32$ " and the  $1/36$ "

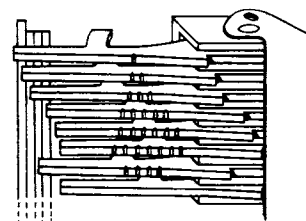


Figure 148. Interposer Overlap, Normal

pitch will have no marking, while the expander cam for the  $1/45$ " pitch will carry a  $\square$ .

The adjustment of the expander can best be read by observing the position of the No. 1 and No. 8 pawls, looking from above and just in front of the rear rail when the carriage is at the right-hand side of the machine. In the event that a complete readjustment of the expander becomes necessary, the following procedure should be used as a guide.

Move the carriage to the right and permit it to rest on the escapement pawls. Set the expander control in the expanded position and observe the alignment of the interposers with the tails of the pawls. Set the expander control in the normal position and again check the alignment of the interposers. In either position the escapement pawls should project over the faces of the interposers by slightly less than half the width of the respective interposer faces (Figure 148).

By holding the carriage to the extreme right, so that it does not rest on the escapement pawls, the pawl ends will be in line vertically and will

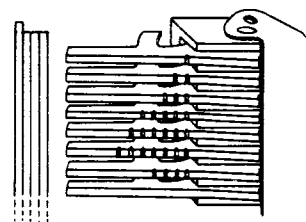


Figure 149. Interposer Alignment

provide a line against which the interposers can be compared to determine that they also are vertical (Figure 149).

If adjustment is required, first determine whether it is necessary to shift the top or bottom of the interposers, then proceed as follows: To shift the bottoms of the interposers to the right or left, loosen the rail support and shift it to the right or left, respectively. To shift the tops of the interposers to the right or left, loosen the locking screw in the slot of the control arm bell crank, attached to the right side of the expander cam, and shift the control arm bell crank to the front or rear, respectively, and lock it with the small holding screw. A stop screw, located in an elongated hole in the rail support, serves as an adjustable stop for the expander bell crank.

The stop screw (Figure 145) will normally be set in the center of the hole and should permit the formed offset on the bottom of the expander cam to cam the small bushing on the lower interposer mounting stud into a full position either to right or left (Figure 150).

### Escapement

Removal of the escapement pawls may be accom-

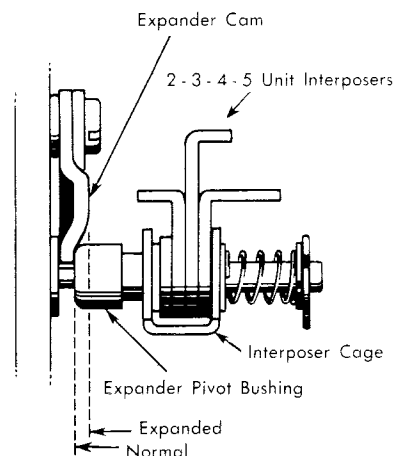


Figure 150. Interposers, Bottom View, Machine Tilted up

plished as a group by removing the escapement pawl bracket and tab lever assembly from the rear rail (Figure 151).

Remove the tab rack, leaving the left inside nut undisturbed, so that the adjustment of the rack will be preserved, and remove the tab lever from its bracket.

Remove the two screws that retain the clutch knockout lever and allow the lever to lie back on the top of the motor. Remove the two bushings which were held by these two screws and remove the screw that retains the horseshoe spring section of the tab lever bracket. The clutch pawl release link and the pawl aligning

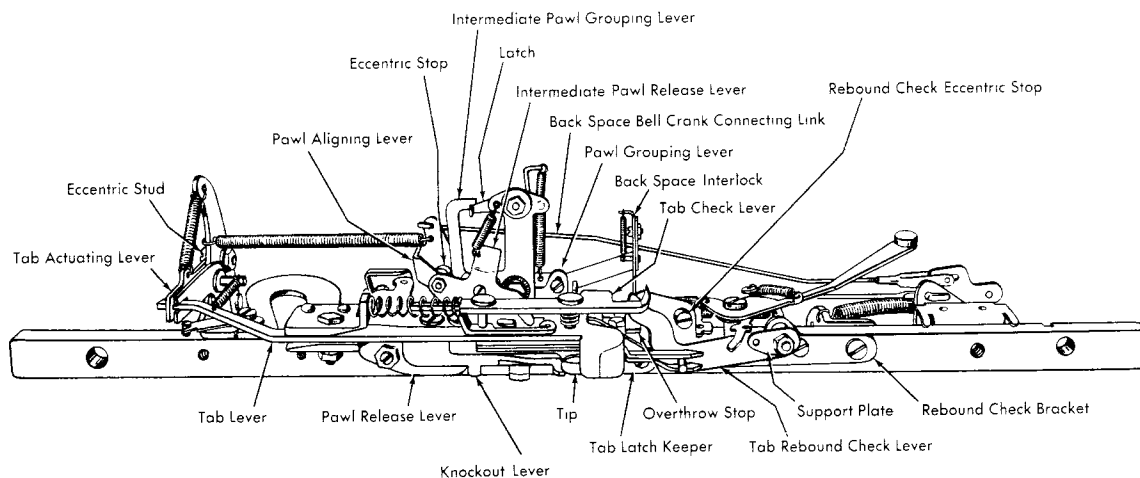


Figure 151. Rail Assembly, Top View

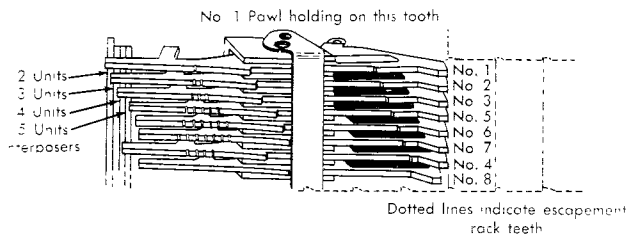


Figure 152. Escapement Pawl Assembly

link should be disconnected from their respective bell cranks. A one-inch length of scotch tape may be applied lengthwise where the clevis joins the link so that the adjustment will be retained during disassembly. Disconnect the tab operating link and any necessary springs. Block the carriage so that it will not start to travel as soon as the pawls leave the escapement rack.

After the pawl block assembly is removed, individual pawls may be removed by removing the horseshoe clip that retains the pawl stud (Figure 152). The stud may then be removed through the top of the block. The steel band that serves as a stop for the notch on the front edge of the pawls may be removed by springing the top off from the small stud that retains it. This will clear the pawls so that they may be removed in order from the top down. The pawl springs must be disconnected, and the pawls must be turned so that they can be lifted upward off the pawl grouping lever.

Replacement should be accomplished in reverse order, with special attention to holding the escapement pawls out of the rack while setting the pawl bracket in place.

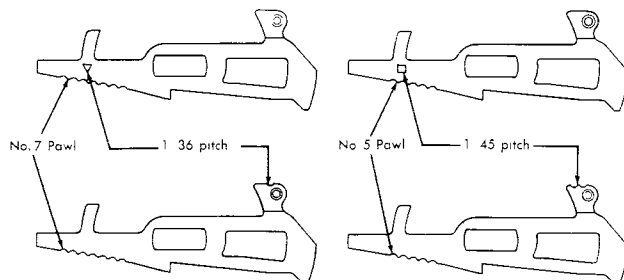


Figure 153. Number and Pitch Identification of Pawls

In replacing individual escapement pawls, the notches cut along the front edge of all but the 8 will show their numerical position. Similar notches cut in the back surface of some pawls, where the pawl spring attaches, indicate either 1/36, one notch, or 1/45 two notches, if they are present (Figure 153). Another method of marking these pawls has been adopted consisting of a  $\Delta$  for 1/36 pitch and  $\square$  for 1/45 pitch. No mark of either kind indicates 1/32 pitch.

The escapement pawl block assembly is equipped with an adjustable plate which may be used to maintain the squareness of the escapement pawls with the rack teeth (Figure 154).

Test the squareness of the escapement pawl tips with the rack teeth by typing a series of lower case letters l, back spacing after each letter so that the l's are each spaced by one unit instead of two units. This test will disclose any variation in the length of the escapement spaces, and where a difference appears between the 8 and the 1 pawls, an adjustment in the elevation of the escapement pawl assembly may be made.

For example, if the test starts with the carriage resting on the 1 pawl, and after progressing to the 8 pawl there appears to be a wider space between the next two letters, then the escapement pawl should be lowered by means of the adjustable plate mounted on the left end of the rear rail. If the opposite effect is noted and a notice-

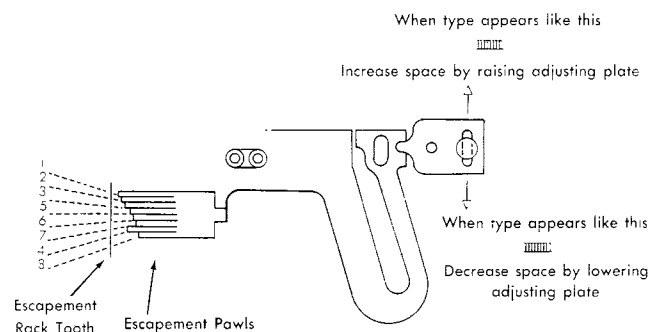


Figure 154. Adjustable Pawl Block Assembly

able closing of the space occurs in the above test, then the pawl assembly should be elevated. Loosen the screws holding the pawl bracket and raise the adjustable plate to elevate the pawls, or lower the plate to lower the pawls. Adjusting the pawl assembly in either direction will be necessary only if the escapement pawls are not square with the rack teeth.

The escapement rack of the Executive machine cannot successfully be replaced without replacing the carriage frame and rack assembly complete. The reason is that the escapement rack and pawl relationship is held to very close tolerance.

### Space Bars

The space bar cam should be adjusted, by means of its adjustable stop, to clear the power roll by approximately .015" in the rest position. The link from the cam to the key lever should be adjusted so that the cam will trip when the key lever has completed two-thirds of its downward stroke (Figure 139). The adjustable stop on the front frame should permit a full stroke of the space bars.

The space bar actuating link must be adjusted so that with the cam on its high point, the interposers will just meet their overthrow stop.

The link from the key lever to the space bar interposer should be adjusted so that the interposer just clears the top of the formed lug on the three-unit space bar actuating lever by  $1/32$ " (Figure 139).

Adjust the link from the actuating lever to the cam so that the back of the lug on the actuating lever just clears the space bar interposer by  $1/64$ ".

Care must be used in working the space bar adjustments to insure that the interposer gets into the path of the lug on the actuating lever

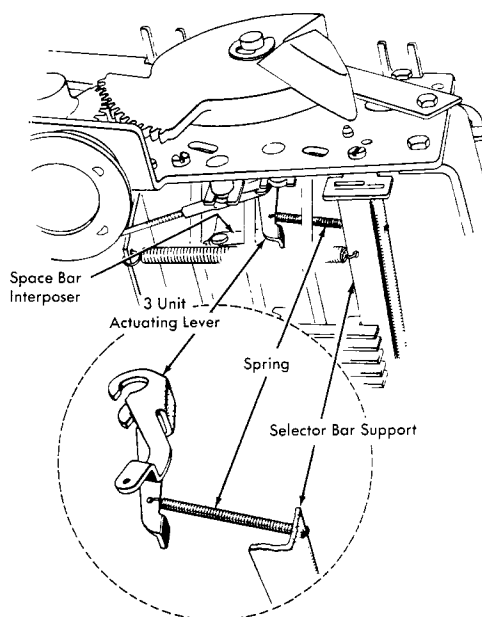


Figure 155. Detail of Space Bar Interposer

before the cam is tripped or only two units will be spaced. It may be necessary to lengthen the three-unit interposer bell crank connecting link by one more turn in order to secure accurate operation.

The operation of the three-unit space bar is improved by the elimination of lost motion in the three-unit actuating lever and linkage. A spring connects the three-unit actuating lever to the selector bar support. A hole in these parts accommodates the spring.

The connecting link from the space bar cam to the escapement trip lever should be adjusted to as great a length as possible and still operate the escapement when the space bar cam is rotated by hand.

### Back Space

The back space cam may be removed by first removing the impression control shaft from under the cam knockout bar. Remove the power roll, release the springs and fulcrum pins for the cam knockout bar and slide the knockout bar part way out the side frame on the left. Loosen

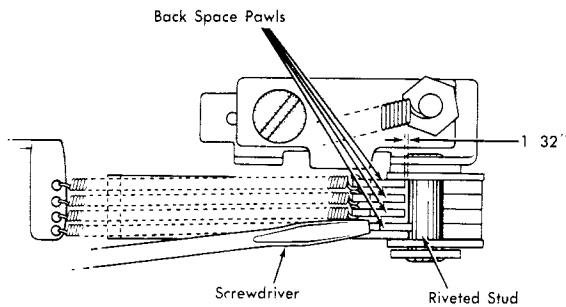


Figure 156. Back Space Link Adjustment

the setscrew that locks the short fulcrum rod for the functional cams. Slide the fulcrum rod out far enough to release the back space cam. Remove the bracket that supports the cam stops. Disconnect the linkage from the cam and remove the cam.

The back space pawl bracket assembly may be removed from the rear rail by disconnecting the four pawl springs and removing two screws which hold the guide pin bracket and the assembly (Figure 156).

The guide pin (Figure 157) must be perpendicular to the rear rail, and because forming may weaken the riveting of the pin to the bracket, the holding screws should be loosened slightly to allow the guide pin bracket to be tapped into proper position. The position of the guide pin must satisfy two requirements simultaneously. The tails of the back space pawls must be held in a line perpendicular to the rail, and the pin must so guide the back space pawls into the rack that the bottom back space pawl will bottom in the rack evenly between two teeth with the carriage resting on the 5 escapement pawl for the  $1/32$  pitch or the 7 for the  $1/36$  pitch. Rarely, due to a build-up of tolerances against the adjustment, it may be found that the carriage must rest on the 6 escapement pawl for the  $1/32$  pitch in order to get the bottom back space pawl to enter evenly in the rack. The carriage rests on the 5 escapement pawl each time the bottom front scale shows an even number.

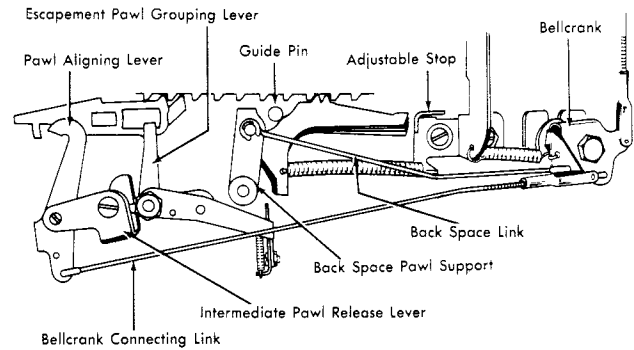


Figure 157. Back Space Mechanism

Observation of these adjustments may be made by tipping the machine up on its back or by the use of a mirror held between the escapement rack and the top of the friction governor plate with the carriage moved to the left. The power roll should be operated by hand. In order to see how the upper back space pawls enter the rack in their turn, the lower ones may be held out of the way with a spring hook.

The adjustable stop for the back space cam should be set so that the cam has a clearance of .010" to .015" with the power roll, and when the cam is tripped, with the power off, the non-repeat lug of the release lever will fall just behind the cam lug. The cam release link should be adjusted to trip the cam when the key is two-thirds depressed.

The back space connecting link which runs from the top of the cam to the bell crank on the rear rail should be adjusted with the cam at rest so that the rear lugs of the back space pawls clear the pin in the back space pawl support by approximately  $1/32$ ". Disconnect the link from the bell crank to the pawl aligning lever. Operate the back space slowly by hand and observe the amount of carriage motion by comparing a mark on paper in the machine to one of the scale graduations on the right-hand card holder. Adjust the back space pawl stop until the amount of positive carriage motion measures approximately  $1-1/2$  units.

Operate the back space slowly until the back space pawls are against the stop with the cam on its high point. Pull the pawl aligning link, which was disconnected, until the pawl aligning lever rotates as far as it will go and adjust the clevis until the pin in the clevis matches the left-hand end of the slot in the bell crank. This is the position of the aligning lever at the height of back space operation with the escapement pawls held to the extreme left and the working faces of the escapement pawls aligned in reverse order so that a one-unit movement of the carriage to the right will take the carriage off from one pawl on to the next.

If this link is too short, it may hold the escapement pawls so tightly against their mounting pin that some of them may be prevented from springing back into the escapement rack after a back space attempt. This binding would result in the back space mechanism performing properly but resulting in no back space gain when used on certain pawls.

Check the pawl aligning lever for straightness. With the back space cam on its high point, and holding the pawl aligning lever rotated as far as it will go, try each escapement pawl for movement to the left. If pawls at the top or at the bottom can be moved an appreciable distance, .010" - .020", then the pawl aligning lever is apparently bent and must be straightened before satisfactory back space adjustment can be made.

### Rotary Back Space

Adjustment of the rotary back space mechanism should be carefully checked according to the following procedure. No bending or forming adjustments are required or advised.

The back space pinion gear must mesh properly with the rack teeth (Figure 158). Adjustments may be made by removing the ratchet wheel and

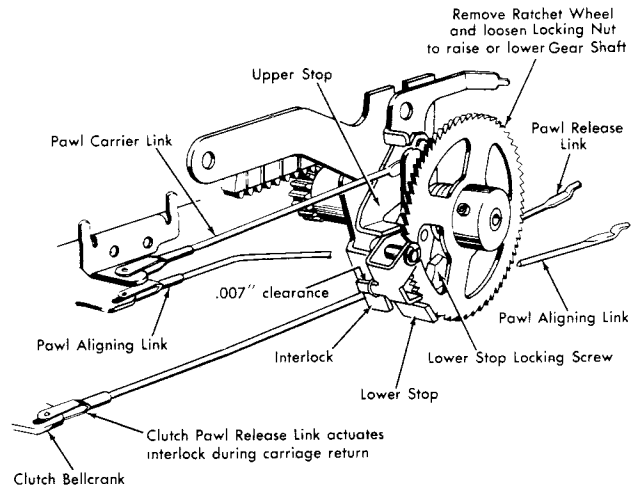


Figure 158. Rotary Back Space Mechanism

loosening the screw which holds the main bracket to the rear rail just over the ratchet wheel. Also, loosen the hex nut, just below this screw, which locks the upper pawl stop. By loosening these two screws only slightly, the bracket may be tapped up or down until the pinion gear has no more than .005" back lash and will permit free movement of the carriage, without binding, for the full length of carriage travel. Replace the ratchet wheel.

The back space cam stop must be adjusted to provide .015" to .020" clearance between the power roll and the cam. Test for this clearance by tripping the cam and observing the lugs on the cam release lever. The cam lug should move just far enough to permit the non-repeat lug of the release lever to rest on the rear half of the cam lug.

The back space pawl carrier link, indicated in Figure 159, should be adjusted so that the slot

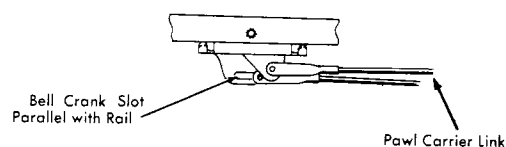


Figure 159. Proper Adjustment of the Pawl Carrier Link

in the bell crank on the rear rail will lie parallel to the rear rail when the back space is at rest. This adjustment, when properly made, insures that the bell crank will transmit the full amount of motion from the cam and will therefore be enabled to put full motion on the back space pawl.

After checking the last previous adjustment, the back space link from the cam to the bell crank must be checked to insure that it just bridges the gap between where it connects to the bell crank and to the cam itself, with the cam resting against its stop. When these two links are in proper adjustment, the pawl will be held tightly against the upper pawl stop by the back space bell crank spring. In this position, the upper stop will hold the pawl out of engagement with the ratchet. If the pawl is allowed to drag on the ratchet, it could interfere with the free travel of the carriage during escapement and cause piling.

The back space ratchet must be adjusted and locked on its shaft by its setscrew. When the ratchet is properly positioned on the shaft, the pawl will enter about one-third down on a ratchet tooth (Figure 160).

The lower pawl stop should be set, by partially loosening the hex head locking screw just under

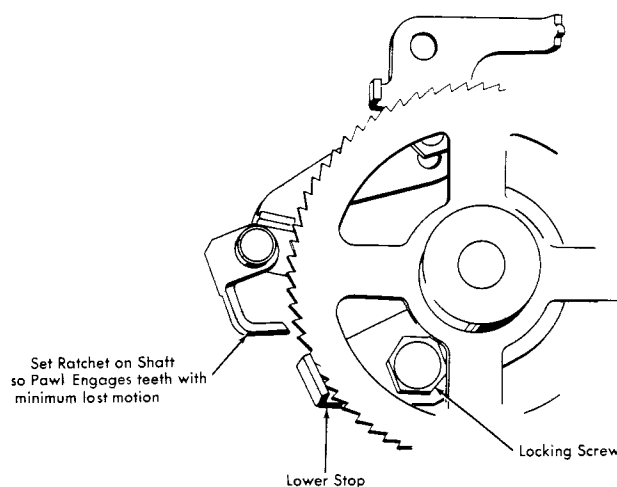


Figure 160. Stop and Ratchet Adjustment

the ratchet wheel and tapping the stop up or down (Figure 160). Select a position for the stop, where it will limit the motion of the pawl just before the cam reaches its high point, and lock the screw in place. The cam should then have about 1/4" of travel before passing its high point. Such a setting will warrant that the carriage motion will be halted at the proper instant to prevent excess back spacing.

The pawl aligning link, connecting the pawl aligning lever and the slotted hole in the back space bell crank (Figure 158) must pull the escapement pawls into alignment upon operation of the back space cam. Check this adjustment by placing the cam on its high point and, with slight finger pressure against the pawl aligning lever in the direction of its operation, observe that the escapement pawls will have moved completely up to the limit of their motion. Another check for this adjustment is to place the cam on its high point, adjust the pawl aligning lever link until the aligning lever has a minimum of play, then shorten the link by one more half turn, to overcome any lost motion in the linkage under power. If this link is set too short, it may hold the escapement pawls so tightly against their mounting pin that some of them may be prevented from springing back into the escapement rack after a back space attempt. This binding would result in the back space mechanism performing, but resulting in no back space gain when used with certain pawls.

In order to check the adjustment of the back space interlock, it will be necessary to have the back space pawl engaged and against the lower stop, with the cam on its high point. Then, with the pawl release lever resting properly against the rear rail, there should be a visible .007" clearance between the interlock and the back space pawl (Figure 158).

To adjust this clearance, first adjust the link

from the intermediate pawl release lever to the interlock so as to permit .007" clearance between the back space pawl and the interlock lug with the back space cam on its high point.

With the back space cam at rest, adjust the link from the interlock to the clutch bell crank so that the escapement pawls clear the rack by .010" to .015" during carriage return. Check this by turning the power off just after touching the carriage return button. This action should pull the pawls out of the rack and hold them there until the check is made.

Test the back space operation in several different places along the rack, using all eight pawls.

The rotary back space mechanism, initially designed to accommodate the fine 1/45 pitch spacing, can be incorporated with the 1/36 and 1/32 pitch escapements. The relationship of the parts follows the listing shown here.

Pitch Escapement	Pinion Teeth	Pitch of the Back Space Rack
1/45	16	10 teeth to the inch
1/36	20	10 teeth to the inch
1/32	18	8 teeth to the inch

It is not advisable to change existing machines to the rotary back space, since the main spring drum has been relocated to accommodate it and changing of the escapement rack would be required.

The bell crank used on the rotary back space is altered from that used on the pawl-type of back space in that the clevis pin hole has been made smaller and the length of the rear upper arm is greater, in order to put additional motion on the pawl and ratchet.

## Grouping Mechanism

Removal of the pawl grouping parts presents no special problems, but caution is to be observed in the re-assembly in order to place certain washers in their proper places. One small washer appears between the intermediate pawl grouping lever and the intermediate pawl release lever on the lower screw, while a larger washer is carried on the upper screw, between the intermediate pawl release lever and the bushing that supports the screw. If any of the washers in the assembly are lost or assembled in the wrong manner, binds may result.

Originally, the grouping mechanism employed a special unlatching pawl assembled in the pawl block below the 8 pawl. An improved design eliminated the unlatching pawl by using the 4 and the 8 pawl for the purpose of unlatching the grouped arrangement of the escapement pawls after each operation of carriage release, carriage return or tabulation. The adjustments for the grouping mechanism are identical, regardless of whether the unlatching pawl or the 4 and 8 pawls are used.

Check the height of the tab lever to see that it clears the margin rack by .005" to .015".

Check the tab latch adjustment for 1/2 to 2/3 bite on the tab stop.

Adjust the pawl release lever so that the escapement pawls clear the escapement rack by 1/64". Check the rest position of the pawl release lever to see that it lies flat against the rear side of the rail.

By looking at the bottom of the assembly, see that the pawl aligning lever bail - the bail which aligns the pawls during back spacing - lies against the escapement pawl block. If the bail cannot reach the block, form the angular tip of the intermediate pawl release lever upward to

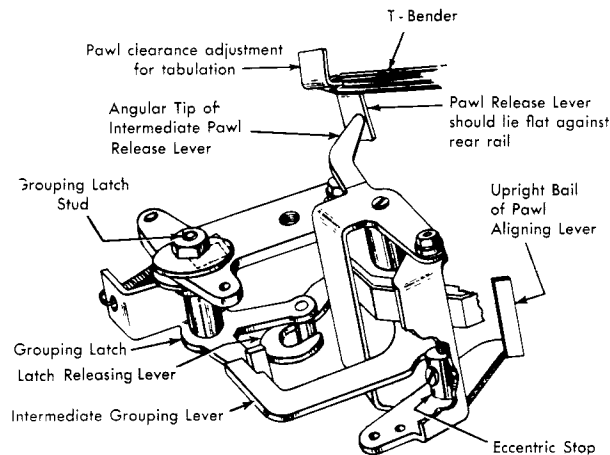


Figure 161. Pawl Release Mechanism

permit the condition (Figure 161). The tip should not be formed any higher than necessary to accomplish this purpose. At rest, the pawl release lever should lie against the back of the rail, the angular tip of the intermediate pawl release lever should just touch the pawl release lever and, at the same time, the bail of the pawl aligning lever should be able to touch the pawl block. When this relationship exists between these parts, there will be no lost motion in the grouping or clearing of the pawls.

Two types of grouping latch have been used. One type is a solid latch (Figures 161, 162 and 163, the other is an adjustable, two-piece latch.

The solid latch may be adjusted by first operating the escapement until the carriage rests on the 1 or 5 pawl. Position the latch stud to the rear of its enlarged hole and move it to the right or left until one unit or less clearance exists between the latch and the intermediate pawl grouping lever (Figure 163). On 1/45" escapement machines this clearance should be as small as possible because less unlatching motion is available.

The adjustable grouping latch can be identified by a small adjustment locking screw in the

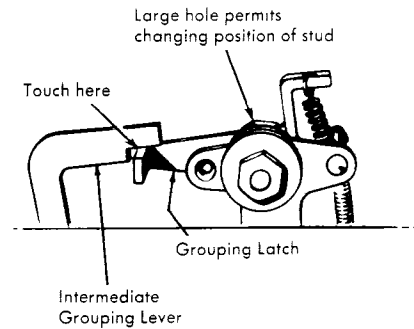


Figure 162. Latching of the Intermediate Grouping Lever

latch itself. This screw secures the latch to the latch adjusting plate (Figure 164). The grouping adjustments are made in the normal manner except for the initial adjustment of the latch.

Loosen the grouping latch stud and move it to the rear of its elongated hole.

The intermediate pawl grouping lever is adjusted by rotating the stud which bears the eccentric stop (Figure 161). The stud serves as a mounting for the pawl aligning lever. The stud has a screwdriver slot in the bottom end and is locked by a nut on the top. The setscrew in the eccentric stop should remain tight. Latch out the tab lever and turn the stud from the bottom to a position where the grouping latch will fall into the notch of the intermediate grouping lever and clear the face of the notch by .001" to .004", with the tab lever still latched out (Figure 162).

If the grouping latch does not touch, or bottom, in the notch of the intermediate grouping lever, the pawl grouping lever (Figure 165)

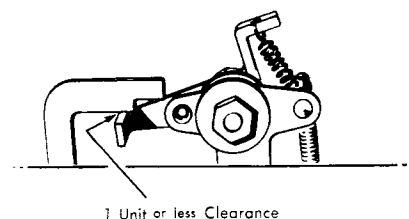


Figure 163. Unlatched Intermediate Grouping Lever

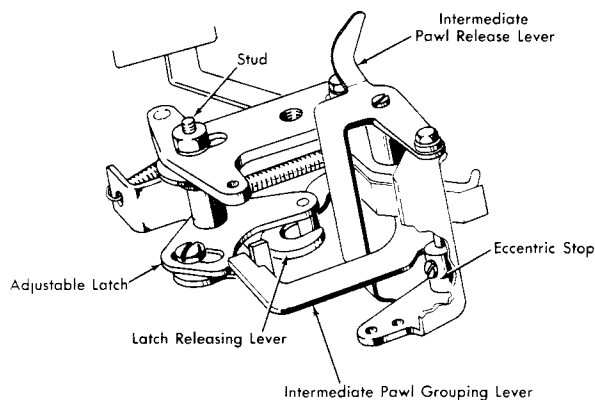


Figure 164. Adjustable Grouping Latch

may be positioned too far toward the tails of the pawls causing them to be overgrouped. This condition would permit the spring lugs of the 4 and 8 pawls to limit the travel of the latch.

The pawl grouping lever should be adjusted (Figure 165) to just group the pawls (Figure 166) when the tab lever is latched out. The pawls can be seen by moving the carriage to the extreme right. To adjust the grouping lever it is necessary to unlock both the adjustment locking screw and the pivot stud (Figure 165). Tighten both securely when the grouping lever is positioned correctly. Note

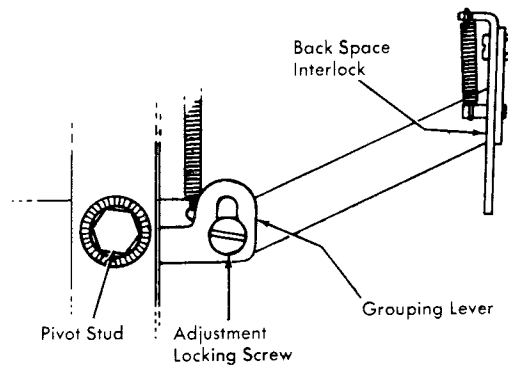


Figure 165. Pawl Grouping Lever

that the escapement pawls are properly grouped when the 4 and 8 pawls touch the pawl stop while the 3 and 7 pawls lack one unit of touching (Figure 166). If the 4 and 8 pawls do not touch the pawl stop, the pawls are overgrouped.

If the 3 and 7 pawls are less than a unit from the pawl stop, the pawls are undergrouped.

Check for proper grouping of the pawls by holding the carriage to the right with the tab lever latched out and observe that the 4 and 8 pawls touch the pawl stop. Move the back space interlock lever slightly toward the front of the machine. This motion should move the 4 and 8 pawls away from the pawl stop and, upon release of the interlock, the 4 and 8 pawls should again touch the stop.

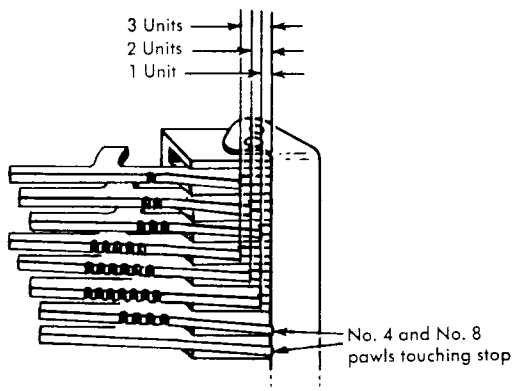


Figure 166. Escapement Pawls Grouped

## Tabulation

The tab cam may be removed by first removing the impression control shaft from under the cam knockout bar. Remove the power roll, remove the fulcrum pins from the cam knockout bar and move it part way out the right side frame. Loosen the setscrew that locks the short fulcrum rod for the functional cams on the left-hand side. Slide the fulcrum out far enough to release the tab cam. Remove the bracket that supports the cam stops. Disconnect the linkage from the cam and remove the cam toward the rear.

The tab lever assembly, including the tab check lever, may be removed by removing the stud and the two locking nuts that support the tab lever in its bracket (Figure 167).

The tab lever and escapement pawl assembly

may be removed by removing the three studs that hold the assembly to the back of the rear rail. Two of these studs hold the clutch knockout lever, and the third holds a steel clip against the tab lever bracket. In replacing this assembly, due care must be taken to insure that the escapement pawls lie against the rear of the escapement rack and that none is caught under the rack when the screws are tightened.

Also to be considered is a shim which may or not be present between the bracket and the rear rail. The purpose of such a shim is to hold the bracket far enough to the rear that the pawls stop does not rub on the escapement rack. The stop referred to is a small narrow band of steel that lies in front of the pawls and serves to catch on the hook in the front edge of each pawl so as to rotate the pawl into the rack when the pawl spring pulls the pawl to the right. The pawls

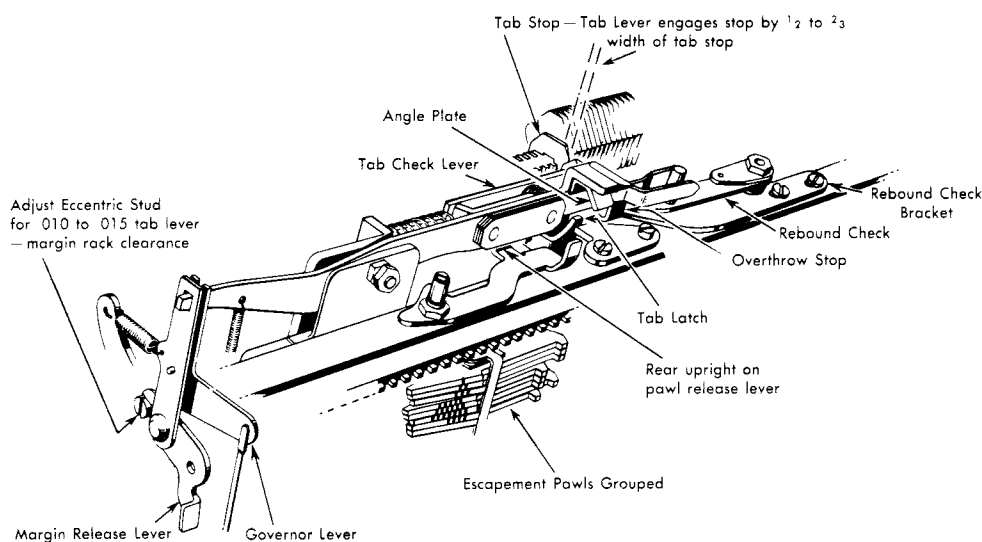


Figure 167. Tabular Mechanism

stop is not to be confused with the escapement pawls overthrow stop which may be removed permanently since experience has not justified its use.

Adjust the tab cam by means of its stop, to clear the power roll by .010" to .015". Test for this adjustment by releasing the cam with the power turned off. The non-repeat lug of the cam release lever should fall just behind the cam lug when the tab key is released.

The tabular lever height is to be adjusted, by means of the eccentric stud under the tab actuating lever (Figure 167), until the tab lever clears the bottom of the margin rack by .010" to .015".

The rebound check lever is to be adjusted for height in order to permit it to catch securely on the tab stops without slipping under the bottom edge. If the rebound check lever is very close to the bottom of the stop, the support plate on top of the rebound check can be formed upward to permit the rebound check to reach about .010" above the bottom edge of the stop. If the rebound check rubs on the bottom of the tab check lever, there is a possibility that the two will lock and grip a stop and not release it; therefore, the support plate on the rebound check should be formed downward, slightly, to prevent this rubbing.

The tab check lever, which is the sliding member of the tab lever assembly, should cover  $1/2$  to  $2/3$  of the tab stop when it is latched out. The latch keeper, mounted on the top of the rear rail, has a large mounting hole which permits the necessary adjustment. At the same time, observe that the tab latch is securely latched on the keeper by .030" to .040". The overthrow stop, part of the rebound check bracket, should be left loose for this adjustment.

The rebound check is mounted on a bracket with

two elongated holes, permitting the bracket to be adjusted along the rail until the rebound check clears the right-hand face of a tab stop by .010" when the tab lever is held in the latched position by hand. At the same time, the upright lug on the rebound check bracket must be set to serve as an overthrow stop for the tab lever (Figure 167). The lug should be so positioned as to prevent the rear edge of the tab check lever from actually touching the front face of the tab rack. If the overthrow stop is adjusted so that it halts the tab lever motion too early, then the tab cam will be overloaded and may fail to function properly or to latch the tab lever out into position for tabulating.

The rear upright lug on the pawl release lever is to be so formed that, with the tab lever latched out, the escapement pawls will clear the rack by  $1/64$ ". The forming may be done with a T bender applied to the horizontal part of the pawl release lever (Figure 161).

The two connecting links that operate from the cam through the intermediate lever must be properly balanced in order to deliver the proper motion to the tab lever assembly. The front link is to be adjusted to such a length that the front edge of the intermediate lever is perpendicular to the front link. The rear connecting link should then be set just to relieve the tab actuating lever from bearing against the tab lever. This adjustment will insure sufficient leverage to latch the tab lever. Check by rotating the tab cam to its high point. The tab check lever should just clear the front of the tab rack. Further adjustment of the front link may be needed to attain the above result.

The tab rack should be adjusted to the right or left until, with the carriage resting on the 2 or 6 pawl, the tip of the tab check lever will be in line with the nearest set tab stop.

Carriage tension should be checked by holding

the carriage so that the tab check lever is at the last tab stop. Latch the tab and let go of the carriage. There should be just enough main spring tension to unlatch the tab lever without hesitation.

The friction governor pawl should be adjusted to secure engagement in the friction ratchet teeth by the thickness of its own metal. The pawl should safely clear the ratchet with the tab at rest.

The friction governor pressure should be adjusted, by means of the two locking nuts on the hub of the main spring drum, until the speed of tabulation is materially checked and a solid, positive action results but without damage to parts. Normally, a satisfactory setting of the friction governor may be made by adjusting it so that the carriage travels at the same speed during tabulation as during carriage return.

The tab set lever bracket should be adjusted to the right or left until the set lever can strike the nearest stop squarely in the center with the carriage resting on the 1 or the 5 pawl. Depress the carriage release lever and release it. This action will group the pawls and will result in the carriage resting on one of these two pawls.

The operator should be instructed to use the carriage release levers when locating the carriage to set the tab stops. This will group the pawls and will cause the carriage to rest on the 1 or the 5 pawl while the setting is made. The result is that the carriage will tabulate to the same spot which has been selected. If the pawls are not grouped before a setting is made, the carriage may tabulate to a different position because tabulation always locates the carriage on either the 1 or the 5 pawl.

#### Carriage Return

The Executive carriage return varies from the

standard only in that an added function must be controlled to group the escapement pawls during carriage return. This is accomplished by attaching an extra chain of linkage from the clutch operating lever back to the intermediate pawl release lever.

Removal follows the same procedure as the standard machine.

The roller latch or latch clutch is used on all Executive machines.

Adjust the carriage return cam stop so that the cam will clear the power roll by .010" to .015", or so that, when the cam is tripped with the power off, the cam lug will fall just behind the non-repeat lug of the cam release lever.

Adjust the cam link so that when the clutch operating arm is as far out as the clutch lever and roller will permit, the cam will be just touching the cam stop.

Adjust the latch link, which runs from the clutch latch to the lower bell crank, so that when the clutch is unlatched, the right-hand arm of the lower bell crank will lie in a line parallel to the rear rail.

Adjust the clutch lever link, which runs from the clutch lever to the upper bell crank, so that with the clutch unlatched, the slot in the upper bell crank will be parallel to the rear rail.

Adjust the latch eccentric so that there is a clearance of .005" to .015" between the latch and the clutch lever when the cam is on its high point. The high point of the eccentric must be kept in the outer half of its orbit. If minimum clearance cannot be obtained by adjusting the eccentric, the cam link may be set one or two turns shorter, but this should be avoided as far as possible.

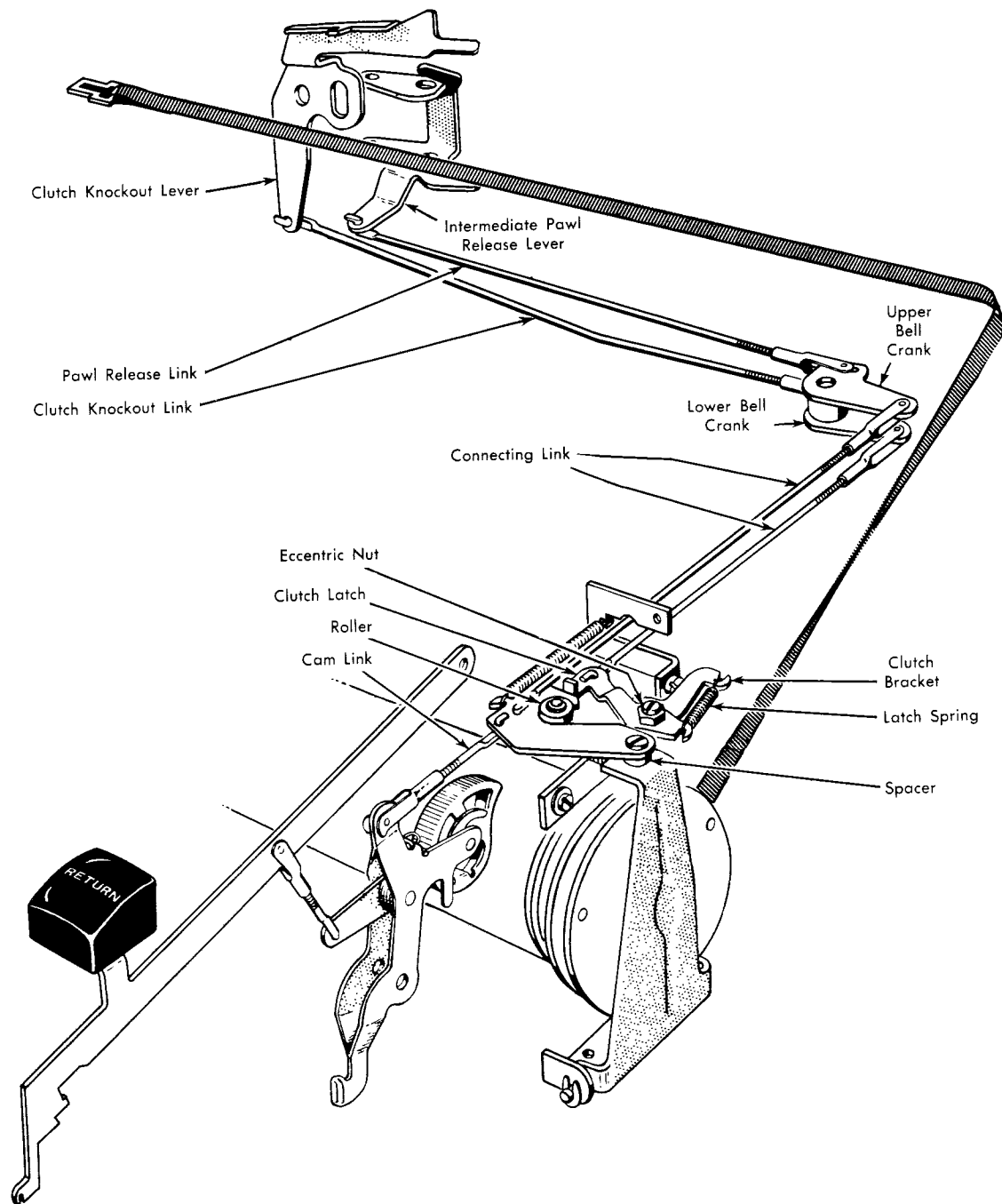


Figure 168. Roller Latch Clutch - Executive

Adjust the tip of the clutch knockout lever so that when it touches the angular undersurface of the tab lever extension, with the tab lever in normal position, the highest point of the clutch knockout lever will be .005" to .015" below the undersurface of the margin rack.

Adjust the clutch pressure, by means of the lock

nut and compression spring under the clutch, so that the carriage will just return to the left-hand margin when operated on triple line spacing from a 1-1/2" return.

If the carriage tends to creep away from the margin during repeat line spacing, especially on double or triple line spacing, a number of extra

adjusting steps may be taken to clear the difficulty.

Reduce escapement pawl clearance as low as possible and still not permit the pawls to drag.

Adjust the clutch pulley spring by winding it up all the way and attaching the tape without backing off.

Re-form the clutch pulley spring by drawing the spring between the fingers, held in a cloth, in such a manner as to reverse partially the main part of its curve.

Reduce the strength of the hook lever spring as much as possible without causing the index pawl to interfere while turning the platen backward.

Reduce the clutch disc-plate clearance until only sufficient clearance exists to permit the tape to be free, with the power on.

Set the clutch knockout lever as low as possible and still guarantee positive unlatching.

Adjust the overbank to 5 units instead of 4-1/2 units to permit the pawls just a little more time to restore to the escapement rack.

All of these adjustments are aimed at reducing the effects of whip in the carriage return tape.

#### Carbon Ribbon Feed

The carbon ribbon feed is driven by the ribbon feed cam which is tripped by each cam lever as it operates on the ribbon lift operating bail. Adjustment of the feed should be made in the following manner.

Check to see that the upper part of the ribbon center guide is formed toward the platen in order to hold the carbon ribbon as close to the platen

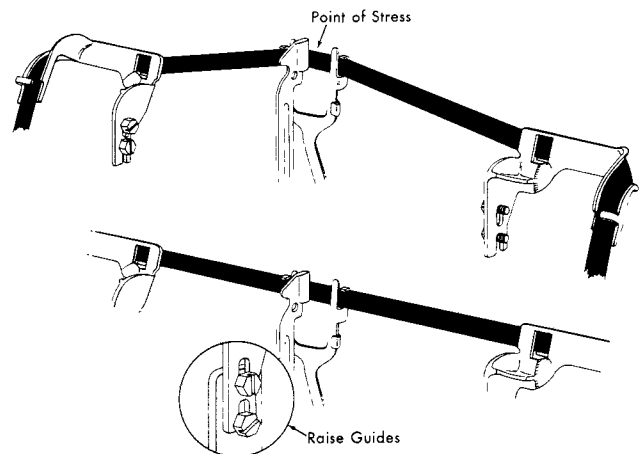


Figure 169. Adjustment of Ribbon Corner Guides

as possible and not cause the center guide to bind on the line gage card holder. With the multiple copy lever at zero, the line gage card holder should clear the platen by the thickness of one tab card.

Adjust the ribbon lift, by means of the adjustable link on the ribbon center guide, so that the diagonal character will strike in the middle of the ribbon. If any character strikes and cuts the edge of the ribbon, particularly the top edge, a very slight tearing action will cause the ribbon to break. If one character lifts the ribbon too high, or not high enough, the hook on the cam lever may be peened to compensate (Figure 128).

Adjust the corner guides high enough to relieve the strain in the center guide and to discourage breakage at that point. Check to see that the guides do not interfere with the top cover. Socket wrench 9521726 may be used on the hex head screws. The die cast corner guides are made with small ribs over which the ribbon can ride with a minimum of friction. Modification in the rear projections of the die cast guides also prevents the guides from interfering with paper forms and envelopes. Check to see that the machine is equipped with the proper design of corner guides in case of interference. Interfering projections on older style guides may be

filed off. Die cast guides should be given a high polish with folded crocus cloth passed back and forth through the guides.

Check the drive spring belt for proper tension. The belt should be just tight enough to take up the slack ribbon as it is fed through the feed rollers. If it is too loose, characters will overlap and result in poor impression as well as in weakening the ribbon. Loose tension on the spring belt can also cause the take-up spool to wind the ribbon so loose that used ribbon will override the edges of the spool before the supply spool runs empty. Lubricate the spring belt lightly.

Align the ribbon corner guides and the ribbon pressure roller to keep the ribbon centered at all feed points. If the feed roller shows excessive play in the shaft bearing, the bearing should be replaced by replacing the plate assembly. Keep the bearing well lubricated to reduce wear. Inspect the ribbon by unreeling a length of it

slowly by hand. If the ribbon appears to hang up or fails to reel out freely, it should be replaced.

Typing too heavily or on a too hard platen can contribute to breakage of ribbon; both of these conditions must be kept in mind when inspecting the ribbon feed. Type all the characters two or three times and examine the ribbon carefully during the typing process. At any point where the type appears to bruise the ribbon paper, steps should be taken to reduce the cutting of the ribbon by reducing the impression, reducing the cutting edge of the type face or by using a softer platen.

Adjust the actuating link (Figure 170) so that the feed pawl arm rests  $1/8$ " above the pin in the left-hand magazine plate. Connect the upper, or clevis, end of the link in the hole nearest to the fulcrum of the feed lever. The bottom end of the actuating link must be hooked in the extension of the ribbon lift bail through the second hole from the end.

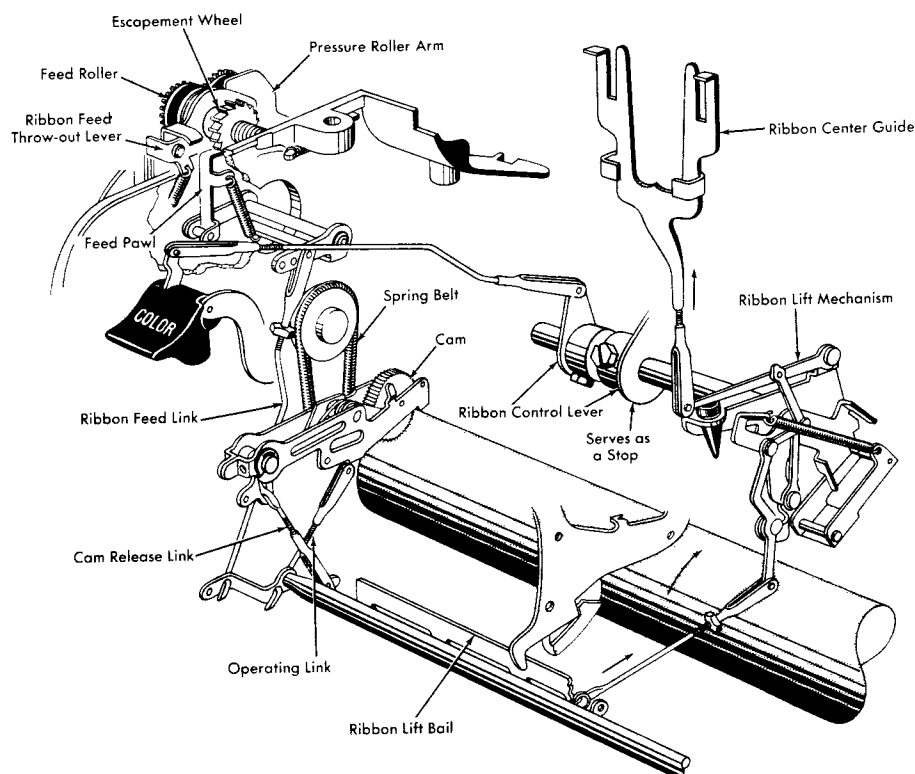


Figure 170. Ribbon Feed Adjustment

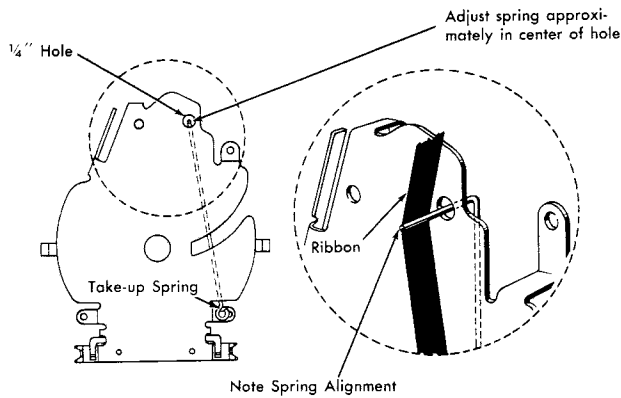


Figure 171. Take-up Spring

The ribbon supply spool hub and the inside of the right-hand magazine cover must be smooth to permit free movement of the supply spool. The ribbon supply indicator in the feed magazine must be free from binds.

The right magazine plate assembly has been equipped with a take-up spring which will insure consistent ribbon tension and uniform feeding by preventing the spool from running out because of the ribbon feed mechanism.

The take-up spring may be installed by drilling a 1/4" hole in place of the ribbon guide pin. The spring may be mounted under the lower rear mounting screw with a small washer between the magazine plate and the loop of the take-up spring. The formed, upper end of the take-up spring should project through the center of the 1/4" hole far enough to accommodate the width of the ribbon. Any possible interference with the supply spool indicator should be prevented by forming the take-up spring if necessary. Some advantage may be gained by placing the outer loop of the ribbon outside of the riding shoe of the indicator.

#### Modified Cam Knockout

The modified cam knockout effects a smooth transition from driven travel to free travel of

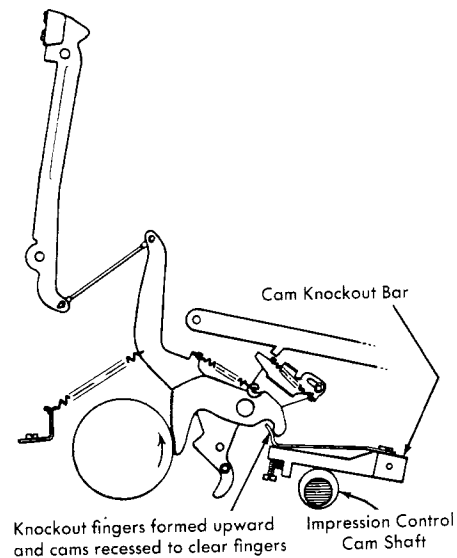


Figure 172. Modified Cam Knockout

the type bar during operation. This is accomplished by causing the cam to leave the power roll in a more horizontal direction, thereby reducing the tendency for the cam to remain engaged to the power roll at the knockout point. Figure 172 shows the design of the parts concerned.

Modified cams and the formed knockout fingers may be installed by first removing the following parts: Front cover section, key plate, type bars, power roll, cam levers, impression indicator lever, impression control cam shaft and the cam knockout bar assembly.

The impression indicator is removed by first removing the retaining clip. Remove the stop from the Executive machine, because this change calls for installation of a scale of 0 to 10.

The impression control cam shaft assembly is removed by taking out the two screws which hold the left-hand shaft bearing to the side frame.

Initial adjustment of the knockout fingers must be carefully made according to the following procedure.

Shift the type basket to the upper case and back out the impression control screws until the knockout fingers rest on the knockout bar. Move the knockout fingers forward or back on their elongated mounting holes until a position is reached where the type bars will knock out approximately one inch from the platen, with the impression indicator set at 10. This test should be made by turning the power roll by hand. To insure that the knockout finger plates are straight and true, a test should be made of type bars numbered 1, 2, 3, 20, 21, 22, 23, 40, 41 and 42. This condition will provide the most favorable point from which to start adjusting the impression control screws and will insure that none of the cams can hang up on the power roll through failure to knock out. Power roll speed should be adjusted for 95 + 2 - 0 feet per minute. Proper positioning of the knockout plates may be most easily accomplished by moving the plates as far as possible toward the rear of the machine and then moving them about 1/32" toward the front. They should then be in approximately the right place to meet the foregoing requirements.

#### Line Gage Card Holder

The line gage card holder may be adjusted up or down until its upper edge is level with the bottom of the line of type and shows a thin line of white between the type and the gage when viewed from the operator's position. By moving the front dust cover to the right or left on its elongated mounting holes, the gage will be properly positioned for use as a position-finder when it is necessary to make a correction or add copy. Use the following test. If an error has been made in typing and the carriage has been moved so that the typing position is lost, the carriage can be reset by using the vertical edge of the right-hand line gage.

To follow a letter with any other letter, regard-

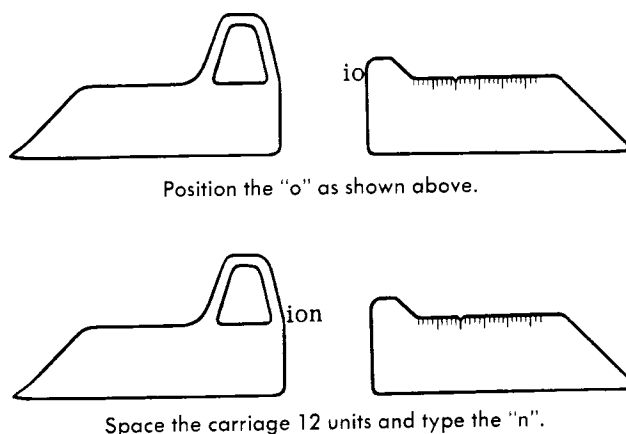


Figure 173. Finding the Typing Position, 1/32 Pitch, Normal

less of width, place the one to be followed so that the right side of it is immediately adjacent to the vertical edge of the line gage, e.g., the o (Figure 173). Operate the space bars and space according to the following table:

Pitch	Units
1/32 normal	12
1/32 expanded	13
1/36 normal	14
1/36 expanded	15
1/45 normal	16
1/45 expanded	17

This will place the carriage in position so that the next letter can be typed in its proper place.

#### Front Paper Scales

The top scale is an inch scale which must be adjusted to correspond to the scale on the paper table and to the zero position of the margin stop. With the margin stop set to the extreme left, the scales should accurately show zero when the carriage is resting at the margin. The carriage should not be held against the margin stop for this reading. A sheet of paper inserted squarely in the carriage will serve as a guide to align the

Figure 174. Front Paper Scales, Executive 1/32 Pitch, 12"

scales. When the scale is composed of a number of sections, on carriages longer than 12", all sections must be adjusted.

The top scale is used for setting margins of a specific number of inches or fractions.

The middle scale is used for centering. To center headings, titles, page copy, etc., locate the paper centrally on the platen, using the paper table scale or the top paper scale. Starting at the zero of the middle scale, make a trial typing of the material to be centered, do not space after the last character, and read the figure on the middle scale. Divide the number by 2, locate this result to the left of the zero, and type the line which will be centered.

The bottom scale is the unit scale. It is marked every four units from zero at the left and is used for setting margin stops and tab stops. The operator should be instructed that, in using the front scale, the carriage release levers must be depressed before the carriage is positioned. This procedure will locate the carriage on a graduation of the scale, since the escapement pawls will have been grouped by the pawl release action.

The bottom front scale can be used for easy identification of the escapement pitch of a machine by comparison to the following table. Note the last graduation on the right-hand end of the bottom scale and compare it to the terminal figure listed.

Carriage Length	Unit Scale Terminal Figure		
	1/32"	1/36"	1/45"
12"	80	90	113
16"	112	126	158
20"	144	162	203

#### Making an Even Right-Hand Margin

Accuracy in the function of all operational features is essential to justification of the right-hand margin, which means making the right-hand margin even, the same as the left-hand margin. The procedure is outlined here.

The right-hand lineage serves as a unit scale. Begin by positioning the carriage so that the place selected for the right-hand margin on paper is at the typing position.

Hold a sharp-pointed pencil in the notch and rotate the platen. This will provide an accurate vertical line from top to bottom of the rough draft sheet. Each time a line is typed, it should be terminated with the vertical line as close to the notch as possible. The vertical line is called a justifying line and is approximately an inch to the right of the right-hand margin.

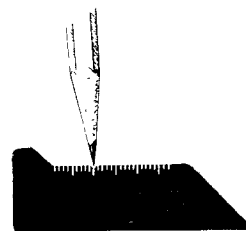


Figure 175. Notch for Justifying Line

The operator should type the copy through the first time using the two-unit space bar and will stop well short of the right-hand margin position to determine whether there is sufficient space left to complete the word, hyphenate or type another word. The right-hand margin stop must be set so as to provide an early warning as the carriage approaches the justification line. The operator will then complete the line but will not strike the space bar after the last character at the end of the line. The vertical line will show how many units must be added or removed from the line of type in order to make it even with the margin. The figure which indicates the number of units short or over may be typed in at a tabulated point to the right of the copy, using the dash to indicate minus. When the vertical line is at the notch, no units will be added or reduced. When the vertical line is to the right of the notch, the line of type must be increased by the number of units indicated by the gage. When the vertical line is to the left of the notch, the line of type must be decreased, in which case the indicating figure in the margin should be typed with the minus sign. It is better to add units of space than to take out units. Taking out space results in crowding.

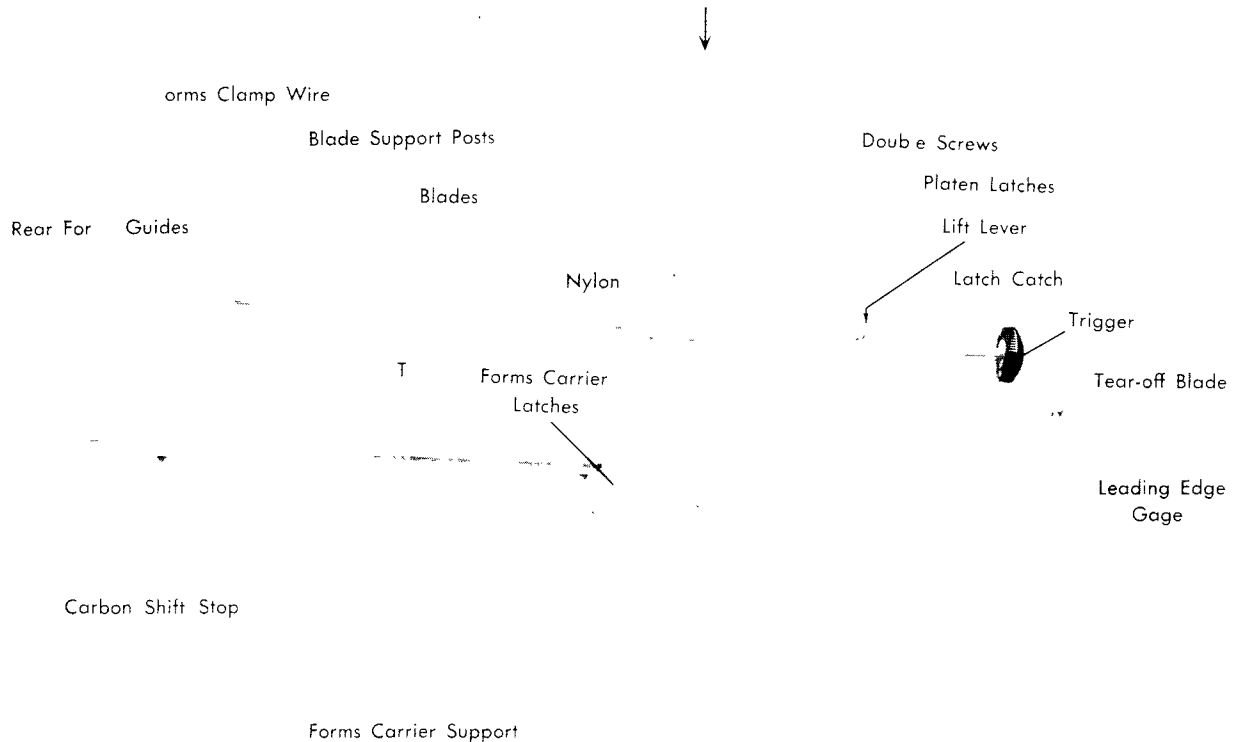
After typing the initial copy, the paper should

be removed from the machine and marked for re-spacing - by using a diagonal mark, for example, where spaces are to be added, or a check mark where spaces are to be removed. Two or more diagonals may be needed between some words. Double units cannot be taken out without running words together. If a choice is afforded, space should be added between tall letters rather than small letters as the wider space is less conspicuous at that point.

When typing the finished copy, increase the space between words by using the three-unit space bar. Decrease the space between words by using the two-unit space bar followed by an operation of the back space. Space is not generally added after a period or a comma.

In general, most letters require three units of space in the lower case and four units in the upper case. Some of the exceptions are the f, i, l and t with two units in the lower case, the w with four and the m with five. Some of the upper case exceptions are I, 2; W and M, 5. The number of units for a given character may be checked by striking the character on paper and counting the number of back space operations needed to strike over the same character.

## SPECIAL FEATURES



## IBM ELECTRIC FORMSWRITER

### MECHANICAL PRINCIPLES OF THE ELECTRIC FORMSWRITER

#### Machine Features

All of the features of the standard electric typewriter are incorporated in the Electric Formswriter except the multiple copy control. Ad-

ditional features include a lifting platen, forms carrier attachment, leading edge gage or register pin assembly, and a tear-off blade.

Continuous forms of either the fanfold or open web design may be used. The Formswriter handles sheet carbon up to 28 inches in length, or carbon packs, and provides for slitting fanfold forms as desired.

The 12-inch Formswriter will accommodate forms up to 9-1/4" wide, using slitter blades, or up to 9-5/8" wide, without slitters. The most commonly used width will be 8-1/2".

The 16-inch Formswriter will handle forms up to 12-1/4" wide, using slitters, or up to 13-5/8" wide without slitters. The most commonly used width on this machine will be 11".

The truck can be moved 19-3/4" from front to rear.

#### Forms Carrier Attachment

The forms carrier utilizes a rigid truck equipped with 10 nylon rollers mounted in pairs. The truck may be operated by a telescopic, adjustable handle. By moving the truck to the rear, against the adjustable stop, a clockwise twist of the knob engages the stop and permits it to be moved forward, with the truck, to a new location.

A small trigger, just behind the knob, releases the telescoping feature which permits the handle to be made longer or shorter.

#### Form Guides

Form guides are provided with small wrench-like handles which may be tightened in position and then aligned so as not to interfere with other parts. Push the handle down on its stud, compressing its spring until the wrench-like opening leaves the hex surface. In this position the handle may be turned out of the way in any direction or turned to secure a better bite on the screw.

#### Forms Carrier Latches

The forms carrier is attached to nylon bushings on the carriage tie rod by means of latches.

The latches are equipped with springs which hold them locked over small pins.

#### Leading Edge Gage

The leading edge gage is pivotally mounted and is provided with a latch which holds it in operating position. If it is required that the top cover be opened, the leading edge gage may be unlatched and rotated so that it extends out to the right where it will be held by the pressure of a spring on the underside of the cover.

The leading edge gage is available in an 8" length, to accommodate forms up to 8-1/2" long. A longer leading edge gage will be needed for forms ranging in greater than 9-1/2" lengths.

#### Top Cover

The top cover on the Formswriter is fitted with a latch on the right, rear corner, which must be depressed in order to raise the cover.

#### Register Pin Assembly

The register pin assembly may be attached to the top cover for use with perforated, open web forms where the leading edge gage is not desired. By placing the perforations of the next successive form over the pins before closing the platen, the forms are brought into register with one another. Springs on the pins permit them to be folded down when not in use.

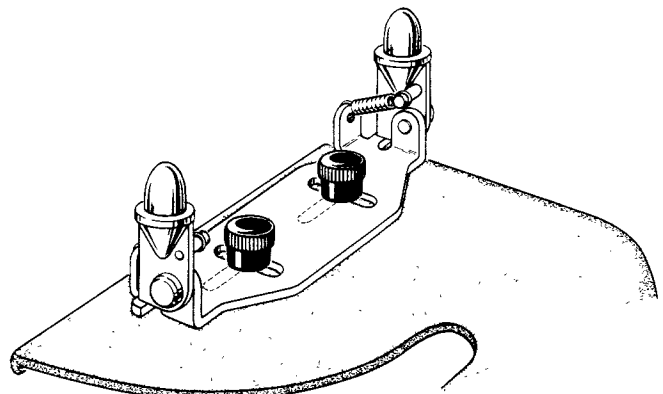


Figure 176. Register Pin Assembly

The pins are set to accommodate forms with perforations measuring 2-3/4" between centers.

Register pins are available in 7/32", 9/32" and 11/32" sizes to fit forms with 1/4", 5/16" and 3/8" perforations, respectively.

#### Tear-off Blade

The self locking tear-off blade snaps into position as soon as the form is held upright in the machine. The tear-off blade is 15/16" above the writing line. Forms are generally made to provide this much margin at the top.

#### Lifting Platen

The platen may be raised, by means of the lift lever, to permit the forms to be held against the leading edge gage and to allow the carbon to be pushed back to the next form. Upon completion of this operation, the platen may be lowered into position where it will be securely latched and where it will lock the tear-off blade in place. During the time that the platen is being latched, the feed roll and deflector assembly is held down away from the platen. As soon as the latches are in place, the feed roll and deflector assembly also restores to working position against the platen. Because of this feature, it is necessary that the deflector be attached to the equalizing shaft more securely than in the case of the standard machine. Thin, hooked-wire springs are used to fasten the deflectors to the equalizing shaft. To prevent loss of these springs, it is advisable that the hook on one end of each spring be closed around the feed roll pivot screw.

#### Carbon Shift

The carbon shift stop is located on a toothed rack on the top of the forms carrier and should be set so that the top edge, or leading edge of the carbon paper will rest approximately 5/8" below the leading edge of the form. The setting should be observed after the form has been

brought to the leading edge gage and the carbon has been pushed back.

#### Telescoping Handle

The telescoping handle is held in position by a pin seated in any one of a series of holes in the bottom of the larger section. The pin is released by the trigger on the back of the knob. This trigger extends through to the rear end of the inner section and is so formed that it disengages the pin from the holes by a lift-camming action. The arm should be shortened each time the operator tears off a portion of used carbon paper.

#### Blades

Blades for supporting the carbon sheets or packs are carried on slotted posts attached to a blade support. On the bottom of the blade support are two positioning pins, one of which is larger than the other. This feature precludes the possibility of the blade support being assembled to the truck in the wrong position. The dimensions and spacing of the pins are the same as those used on former models of electric formwriters.

Blade support assemblies are available in two styles with two sizes of each. The two styles are the 8-blade support assembly, accommodating up to a 9-part form, and the 16-blade support assembly which can support up to a 17-part form.

The 12" size is for forms ranging up to 9-1/4" in width with slitters, or up to 9-5/8" without slitters. The 16" size is for forms ranging up to 13-1/4" in width with slitters, or up to 13-5/8" without slitters.

Fanfold or open web forms may be used, each of which requires a different style of blade.

#### Fanfold Blades

Fanfold forms are so called because of their

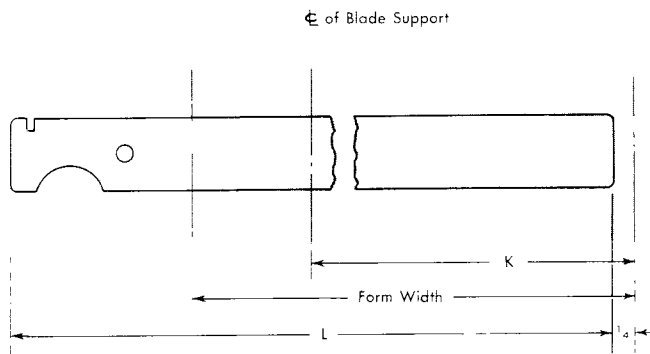


Figure 177. Fanfold Blade

construction. The alternate folding back and forth of the form paper resembles a fan in its design, the purpose of which is to keep the parts of the form in register so that whatever is typed on the original will appear in the same position on the succeeding copies of the same form.

The fanfold blade may be cut to length by allowing 1/4" to 5/16" clearance inside the folded edge of the fanfold form. This clearance is necessary to permit free carbon shifting.

In case it is not convenient to match the blades to the form as it lies in place on the carrier, the formulas given here will serve to guide the cutting of fanfold blades (Figure 177).

Forms Centered on Blade Support

$$12'' \text{ Carriage} \\ L = \frac{\text{Form Width} - 1/2''}{2} + 6 \frac{9}{16}$$

$$16'' \text{ Carriage} \\ L = \frac{\text{Form Width} - 1/2''}{2} + 8 \frac{9}{16}$$

Forms Offset from Center

$$L = K + 6 \frac{5}{16}''$$

$$L = K + 8 \frac{5}{16}''$$

K = Distance from center of blade support to the edge of the fold.

### Slitter Blades

After the fanfold form has been typed, it is necessary to separate the parts of the form in order to distribute them. This process is sometimes aided by the use of slitter blades which accomplish the separation during the carbon shifting operation.

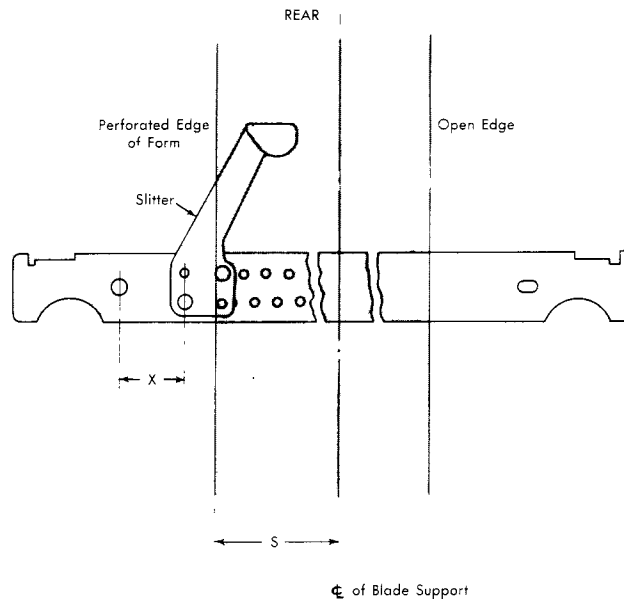


Figure 178. Slitter Blade

In assembling the slitter to the blade, the form should be aligned properly on the carrier, and the form guides should be adjusted to provide a straight central guide for the form. The slitter should be so placed over the holes in the blade that the edge of the form will bisect the edge of the slitter (Figure 178). The rivets should then be inserted and peened down flat to eliminate the possibility of interference between forms. The staggered arrangement of the rivet holes makes it possible to adjust the slitter to any position within 1/8" along the blade.

If it becomes necessary to prepare blades with slitters, without having the machine at hand, the following formulas will prove helpful.

Forms Centered on Blade Support

$$12'' \text{ Carriage} \\ X = 5'' - \frac{\text{Form Width}}{2}$$

$$16'' \text{ Carriage} \\ X = 7'' - \frac{\text{Form Width}}{2}$$

Forms Offset from Center

$$X = 5'' - S$$

$$X = 7'' - S$$

S = Distance from center of blade support to the edge of the fold being slitter.

### Open Web Blades

Open web forms are so called because the web

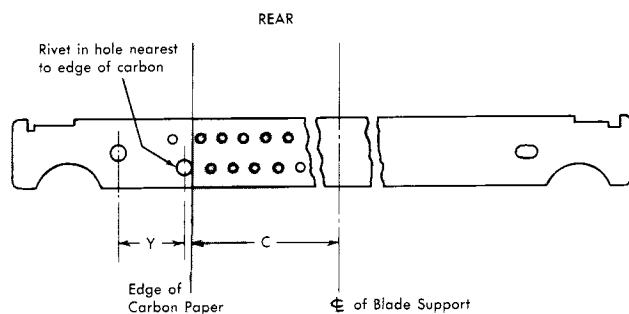


Figure 179. Open Web Blade with Carbon Locator

of forms and carbon paper is open at the edges, and registration is accomplished either by means of a register pin or visually by the operator. Open web forms may also be registered by using a pin feed platen if the forms have perforations along the sides.

Open web blades are supported at both ends in the same manner as slitler blades for fanfold forms.

A rivet may be installed in the open web blade to locate the edge of the carbon sheet for open web forms. The formulas given here will assist in positioning the rivet in the proper hole (Figure 179).

Forms Centered on Blade Support

$$Y = 5 \frac{5}{16}'' - \frac{\text{Carbon Width}}{2}$$

$$Y = 7 \frac{5}{16}'' - \frac{\text{Carbon Width}}{2}$$

Forms Offset from Center

$$Y = 5 \frac{5}{16}'' - C$$

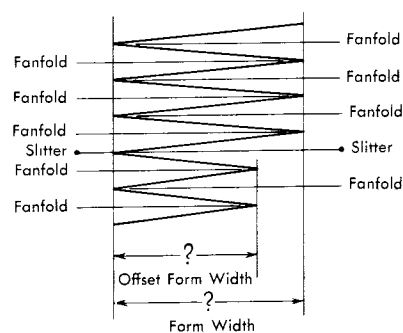
$$Y = 7 \frac{5}{16}'' - C$$

C = Distance from center of blade support to the edge of the carbon sheet.

A straight line scribed across the blade will also serve to locate the edge of the carbon.

### Ordering Blades

Because of the various designs of the different forms it is necessary to provide accurate and complete information when ordering blades. A sample of the form should be submitted with an order for blades. If a sample cannot be secured, an accurate sketch should accompany the order,



Form Face Down, Front View of Leading Edge

Figure 180. Sketch to Accompany Order for Blades

indicating clearly the dimensions of each part of the form.

The sketch should also include the direction from which the sketch is shown (i.e., as the forms lie on the carrier, face down, the front view of their proper arrangement should be shown).

### Threading Forms

The forms should be threaded between the rear form guides far enough to reach the top cover of the typewriter, then held in place by catching the right-hand edge of the forms under the form clamp wire which slides out of the rear form guide. The form may then be laid back over the rear end of the forms carrier and brought forward, one sheet at a time. Any parts of a fanfold form which may be separated by slitler blades should be separated by tearing along the perforated edges.

Blades should be loaded with carbon, either in sheets or in packs, by placing the fold over the blade and attaching a clip. The carbon side should face up. Carbon should be clipped on the blades squarely, unless there may be a tendency for the carbon to run out of either side, in which case the carbon should be shifted slightly off from square enough to overcome the condition. Most applications require a heavier carbon

behind the original form, or provision may be made to have a blank sheet behind the original form to protect the form from embossing.

With fanfold forms on which slitters are not used, the blade should lack  $1/4''$  to  $5/16''$  of reaching the inside of the folded edge.

Blades should be assembled to the blade posts, with the truck to the rear, so that the carbon paper is interleaved with the form. The back of the form should be up, and the top of the form should be toward the front. The carbon should be brought to within  $5/8''$  of the leading edge of the form.

The rear form guides should be set to the width of the form, allowing a clearance of about  $1/32''$  at the edges.

The truck should then be wheeled to the front as far as possible so that the form can be used as a gage in setting the form guides on the tear-off blade.

The supply of forms should always be located as high as possible under the rear form guide to facilitate paper feed and to insure faultless line spacing.

## REMOVAL AND ADJUSTMENT PROCEDURE FOR THE ELECTRIC FORMSWRITER

### Forms Carrier Attachment

The forms carrier may be removed from the Formswriter by pressing inward and raising the small latches on the front forms carrier bracket where it rests on the carriage tie rod bushings.

The forms carrier support may be removed from the machine by springing the frame of the

support outward at the point where it attaches to the machine.

The nylon truck rollers may be adjusted to give the truck a free ride, with a minimum of side play on the carrier track, by means of one eccentric mounting screw for each pair of rollers.

The forms carrier support may be adjusted by shifting its brackets on elongated holes where they attach to the side frames, until the bottom bracket holes have been moved to the rear. This will result in the rear of the forms carrier resting higher than the front, and some advantage will be gained in paper feed since the carbon truck will run downward toward the front more easily. Removal of the rear cover will be necessary for this adjustment.

A two-wheeled truck, attached to the carrier by means of screws in elongated holes, should be adjusted forward or backward until its nylon rollers rest centrally on the third rail of the forms carrier support.

The forms carrier latches are attached to nylon bushings on the carriage tie rod. The left-hand bushing has an elongated hole which permits the rear of the forms carrier to whip independently of the carriage. The right-hand bushing has a round hole and is mounted between two collars. The collars are to be adjusted first to a position on the tie rod where the forms will be properly centered on the platen when the loaded truck is at the front of the carrier. The second of the collars should be set to permit the carrier to have  $3/32''$  side play. This setting of the collars is the most favorable for a free escapement. In the event that tab rebound trouble occurs, the  $3/32''$  side play may be reduced, gradually, until the tab rebound difficulty is resolved. At least  $.005''$  side play should exist under any circumstances. Other tab rebound adjustments

should have been checked before reducing this clearance.

The front paper guides have been eliminated from the forms carrier to prevent the possibility of their being set close to the paper and, in that way, causing the rigidity of the paper forms to destroy the free whipping action of the forms carrier.

The front paper guides, located on the front paper bail, or tear-off blade, should be set just so they clear the edges of the form when the loaded truck is at the front with the forms lying under the raised platen.

### Blades

The blade support posts may be adjusted by turning the blade support over and, by loosening the screws which hold the blade support posts, the posts may be turned slightly and locked in position with the screws. This adjustment is provided to overcome a tendency for the carbon to run out of the edge of a form. Fanfold forms require that the carbon be directed slightly toward the inside of the fold.

### Leading Edge Gage

The leading edge gage should be adjusted so that, by holding the forms tight to the knurled plate when closing the platen, the tear-off line will fall directly along the tear-off blade. This should place the first writing line of the form on the writing line of the machine, provided the forms have been made to this standard with 15/16" from the top edge to the writing line. This is a fixed dimension and cannot be altered by adjustment. Positioning of the form on the leading edge gage is to be accomplished with the carriage at the margin so as to bring the center of the form in line with the gage.

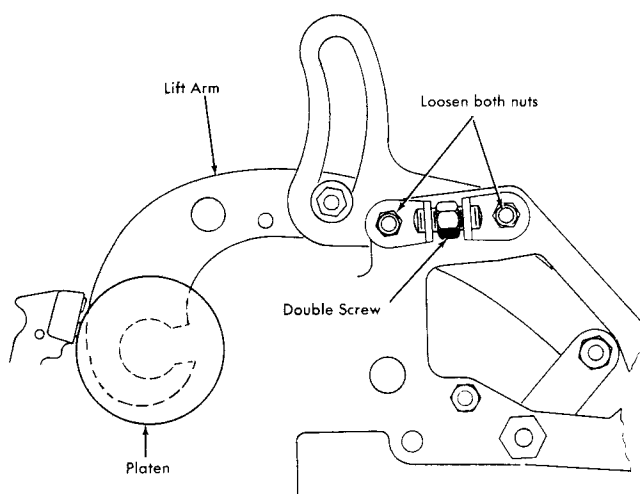


Figure 181. Lift Platen Ring and Cylinder Adjustment

### Lift Platen Carriage

The lift platen may be removed from the lift arms by partially loosening the screws that hold the retaining clips on each of the platen bushings. Removal of the platen is recommended when making adjustments on the rear rail.

Adjustment of the lift platen ring and cylinder is made by setting the double screws, located on the inside of the platen lift arms. The retaining nuts should be loosened before making this adjustment (Figure 181).

Adjust the detent roller arm eccentric so that the index pawl enters a ratchet tooth approximately two-thirds down on the tooth. Adjust the lower pawl stop for a full one-tooth travel and a positive positioning of the platen. To observe these adjustments while operating the carriage return tape by hand with the carriage at the extreme left, the platen should be lowered and latched in position.

Adjust paper clearance by loosening the locking nut on the screw which holds the feed roll release lever to the lever and bushing assembly on the actuating shaft. Move the arm up or down to a position where forms may be shifted in the

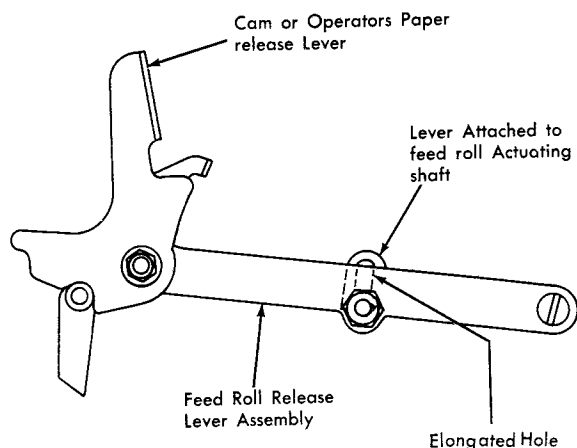


Figure 182. Paper Release Adjustment

carriage when the release cam is moved to its rear position, as it is during paper release, and tighten the screw in place (Figure 182).

Feed roll pressure is adjusted by raising or lowering the locked screw under the center of the paper deflector. If more pressure is required than is available by adjustment, a helper spring may be added inside the standard pressure spring. The helper spring must be coiled in the opposite spiral to avoid being pinched between the coils of the pressure spring.

The latch keepers should be adjusted to the thickness of the forms being used (Figure 183). With the forms in place, the platen should latch

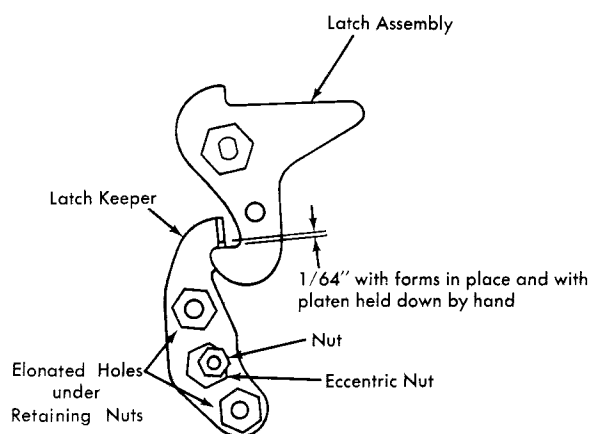


Figure 183. Latch Keepers Adjustment

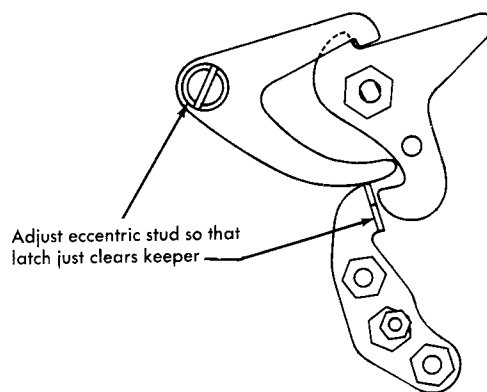


Figure 184. Latch Catch Adjustment

with .015" clearance between the latches and the lower edges of the latch keepers when the platen is pressed down by hand on first one side and then the other. Keepers are adjusted by loosening the two locking nuts, by loosening the locking nut on the stud that holds the eccentric nut, and by turning the eccentric nut until the desired position for the keeper is obtained.

The eccentric stud which supports the latch catch works in conjunction with the latch and trigger so as to time their operation (Figure 184). The latch catch is the wishbone-shaped member attached to the left-hand platen lift arm. As the platen is lowered, the latch catch meets the left-hand latch keeper and is pushed upward until it disengages the latch. This permits both latches to be sprung under the keepers. The eccentric stud which supports the latch catch may be unlocked by loosening the nut on the inside of the stud and rotating the stud until the latches just clear the front surface of the keepers as the platen is lowered. If one latch clears its keeper by more than the other, then the keepers may be shifted slightly forward or back on their mounting screws.

The eccentric stud on the platen lift lever, or lifting handle, which projects out over the top cover, should be adjusted, with the platen latched down, so that the latches will rest half way back under the keepers.

As the platen is lifted, the lift cam support levers strike on screw studs in the carriage side frames which serve to stop the levers and to prevent the carriage from locking in the open position.

#### Carbon Shift

The lever for releasing the carbon shift stop is mounted on the same screw stud which retains the narrow cover plate over the handle support on the truck. If it should be necessary to remove the cover plate for any reason, care should be used so as not to lose the spacer bushing on the stud.

#### Back Space

Because of the added weight of the carriage on

formswriters and long carriage machines, the back space cam will bury itself a little deeper into the power roll than it does on ordinary models. If the back space link is adjusted too long, or if the back space stop is a bit too far to the right, the back space pawl will not meet the stop properly, and the momentum of the heavier carriage will carry it too far. The result will be too much back space. The necessary adjustment is to set the guide lug so that the back space pawl enters the rack with a minimum of clearance between the working faces of the tooth and the back space pawl. Adjust the back space pawl stop as close as possible and still have the escapement pawl just click into the rack on hand operation of the back space. Finally, remove all lost motion from the linkage and cam adjustments.

IBM  
Electric Decimal Tabulation



Illustration of 16-inch, 88 keyboard, Elite, with added decimal point and comma in the numeral row of keys to facilitate writing of figures.

## MECHANICAL PRINCIPLES OF THE ELECTRIC DECIMAL TABULATION

### Machine Features

The Electric Decimal Tabular Feature is optional on order, on the standard IBM Electric Typewriters and on the IBM Electric Formwriter. It provides a means of tabulating accurately to any desired figure position, electrically, by a single touch of any key in the decimal row. The decimal row is located just back of the row of numeral keys.

The tab stop will be normally set, by means of the present Tab Set key, to the position of the decimal point. Operation of the tab key is designed to tabulate the carriage to the decimal position.

If it is desired to skip one or more columnar groups and reach a definite decimal tabular position, the operator may depress the key which indicates the proper column as many times as may be required to reach the destination. For example, if the carriage is at the

left-hand margin with three columns typed and totaled and the operator desires to tabulate to the 10,000.00 position in the third column only, in order to type a grand total:

2,500.00	2,500.00	2,500.00
<u>2,500.00</u>	<u>2,500.00</u>	<u>2,500.00</u>
5,000.00	5,000.00	<u>5,000.00</u>
		15,000.00

the operator depresses the 10,000 key three times and arrives at the position to type the figure 15,000.00.

In listing columns of 100,000,000.00 as close together as possible, it will be necessary to set every 16th stop, counting 15 spaces between stops, for 10-pitch and greater escapements. For 12-pitch and smaller escapements, set every 17th stop. Following this type of calculation, it will soon become quite simple to set stops for the proper spaces.

If the operator should use the 100T decimal tab key and should then change the choice, before typing, and strike the 10T, the carriage would not move to the 10,000.00 position in the same column, but would travel to the 10,000.00 column at the next succeeding tab stop.

### Writing Figures Larger Than 100,000,000

Although the keyboard carries decimal tab keys numbered through 100,000,000, it may be required to write beyond that limit. By setting the tab stop at an earlier position, the carriage may be stopped earlier and larger numbers may be written, still using the decimal tabular mechanism. For example, if the tab stop is moved four spaces to the left, so as to accommodate an additional group, the operator may tabulate to any point from 100,000,000 to the comma before the hundreds position. If the tab stop is

moved eight spaces to the left, the operator may tabulate to any point from 100,000,000,000 to the comma before the hundred thousands position. Since it is unlikely that very narrow columns would be combined with very wide columns, this method provides a practicable means of dealing with numbers of unlimited size. The use of the tabular key when using this expanded system, would not place the carriage at the decimal point, but if it was required for some purpose, another tab stop could be set to control it.

### Mechanical Principles

The decimal tab keys rotate the front bell cranks and pull forward on the interposer links. By means of the rear bell cranks, the interposers are raised to a position in the path of the interposer bail (Figure 185). Selection of the decimal point interposer is secured by means of an inclined lug on the bottom of the tab key, which operates a bell crank and link to the rear of the machine, in the same manner as the other decimal tab keys.

Although there are 10 selective positions to which an operator may tabulate, 12 interposers are used in the assembly. Two of the interposers are mounted on round holes instead of elongated holes and are so located that they represent the comma positions in the typed figure.

The cam is released by the release link, attached to a common operating bail. The bail is actuated by any of the decimal tab keys. Cam release is obtained at the bottom of the key stroke travel. The cam, driven by the power roll, pulls on the operating link and rotates the operating lever so that the right-hand end of the lever moves to the rear. When the tab operating lever lies at rest, it holds the interposer bail toward the front. When the tab operating lever



the tab cam with no interposer latched out. In this case, the carriage would travel all the way to the left as if no tab stops were set. The tab governor would be operative, however. This practice is referred to as "flicking" the keys. Under normal, full-stroke operation no difficulty should be experienced. If flicking is suspected, it will be necessary to check carefully how the keys and interposers are adjusted. Tilt the machine up, remove the bottom cover and depress each decimal tab key in turn, with the power off. The front bell crank latch should spring up and engage the latch bail just before the cam is tripped. Adjustment of the front bell crank eccentrics may be necessary to insure this condition. The interposers on the rear rail should be examined also, to insure that they rise high enough to be engaged by the interposer bail when the cam trips and that they are held high enough by the front bell crank latches.

When instructing typists it should be made clear that a decimal tabular key must be fully depressed. Faulty strokes of the decimal tab keys, while not critical, should be avoided, because improper operation may also result in a lack of selection, causing immediate tabulation to the right margin.

It is possible to get a similar response if the operator repeatedly strikes a decimal tab key out of time with the cam operation so that the latch on the front bell crank is not permitted to restore to its position behind the latch vane. This kind of operation is referred to as beating the tab. If it occurs, it will be necessary to request that the operator adjust the timing of her key stroke operations, not because the key is operated too fast, but because repeated operation of any key must be synchronized with the cam operation cycle.

The rebound check operates on a special added rack under the tab rack. During the carriage

return operation, the rebound release link is required to pull a lever which, in turn, pulls the rebound check pawl out of engagement with the tab rebound rack.

Powdered dry graphite may be used to lubricate the interposers. Oil causes the interposers to adhere to one another, and this results in more than one being raised, or in failure of a raised interposer to restore to rest.

The key lever locking bar has no effect on the decimal tab keys, and it is possible to depress one or more of the decimal tab keys when the switch is turned off. If only one or two of the keys are depressed, the carriage will be expected to tabulate to the first set tab stop when the switch is turned on. If several keys are depressed, the several interposers that are raised by the action will be expected to exert more spring tension against the interposer bail than the bail spring can overcome. The result will be that the carriage will tabulate to the position of the right-hand margin stop and the tabular mechanism will trip off and restore to normal rest position.

The back space mechanism is designed so that it will not interfere with the decimal tab parts. The back space cam rotates the bell crank under the right-hand end of the rear rail and pulls the back space link. The back space pawl slide moves and carries the back space pawl to the right. The spring which extends from the left-hand end of the back space pawl to the escapement pawl causes the back space pawl to bear against the guide pin so that movement of the pawl slide serves to actuate the pawl toward the rack where it engages one of the teeth. Further movement of the pawl carries the carriage to the right until the pawl meets the pawl stop at the instant that the escapement pawl clicks into position in front of the next tooth of the rack.

## REMOVAL AND ADJUSTMENT PROCEDURES FOR THE ELECTRIC DECIMAL TABULATION

The decimal tabkeys are mounted in guide slots which permit a fixed amount of travel up or down. A small, adjustable plate keeps the key levers in place. The bail lugs, operated by these keys, must rest just below the notches cut in the back edge of the decimal tab key levers.

1. Form the lug in the center of the decimal tab key guide so that the majority of the lugs on the bail rest  $1/16''$  below the top of the notches cut in the back edges of the key lever (Figure 185).

2. Adjust the cam release link so that the cam will be released as late as possible but with positive action. This setting will permit interposers to be raised into position where the interposer bail on the rear rail can move them out to the rear.

3. Form the lug on the tab key lever so that there is no clearance between it and the lug on the left-hand end of the decimal tab key lever bail.

4. Check all lugs on the key lever bail to insure that they clear the tops of the notches cut in the key levers by an equal, minimum clearance.

5. Adjust the cam stop so that the cam lug will drop just behind the release lever lug when the cam is released with the power off.

6. Adjust the links which actuate the interposers so that interposers will be raised as high as possible with the decimal tabkeys depressed. Each interposer is mounted on an elongated hole which limits its travel. With the decimal tab keys depressed as low as possible, the links should raise the interposers as high as possible.

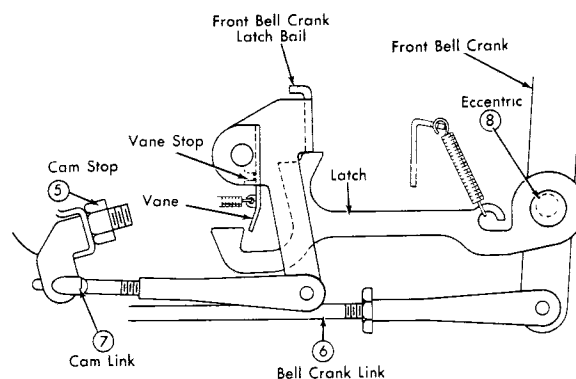


Figure 186. Cam at Rest, Key at Rest

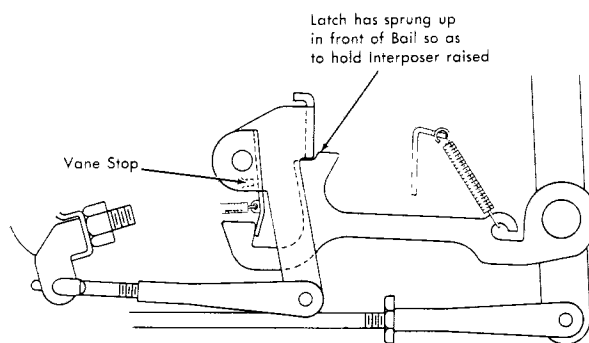


Figure 187. Cam at Rest, Key Depressed, Eccentric Adjusted to Permit the Latch to Spring up in Front of the Latch Bail

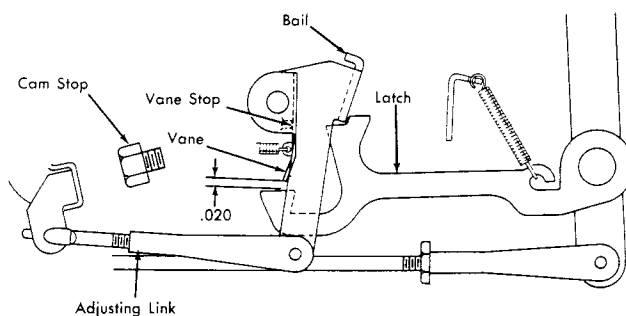


Figure 188. Cam on its High Point, Link from Bottom of Cam Adjusted to Permit .020" Clearance between Latch and Vane

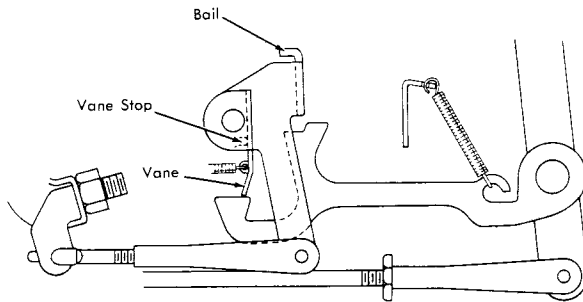


Figure 189. Cam Restored, Key Depressed, Tabular Interposer Restoring, Latch Held Down by the Vane so it May Pass under the Latch Bail and Restore

7. Adjust the link from the bottom of the cam so that, with the cam on its high point, the latch vane under the keyboard will rest in a position which will permit the latches just to clear under it by approximately .020". With the cam at rest, the vane should engage the latches by approximately .020" (Figures 185, 186 and 188).

8. Adjust the eccentrics on the front bell cranks so that the latching surface on the front bell crank latch will safely latch on the front bell crank latch bail before the tab cam is released. With the front bell crank in the latched position its interposer should be raised high enough to allow the interposer bail on the rear rail to engage it properly (Figures 185 and 187).

9. Adjust the tab operating link so that the tab operating lever moves far enough back to latch safely with the cam on its high point (Figure 185).

10. Adjust the tabular rack to right or left so that the escapement pawl will enter the rack as shown after striking a tabular stop. This can be checked by raising an interposer and turning the power roll by hand until the tabular cam is on its high point. This will release the pawl from the rack and allow the carriage to move until the interposer meets and rests against a stop. Slowly turn the power roll backward. The escapement pawl

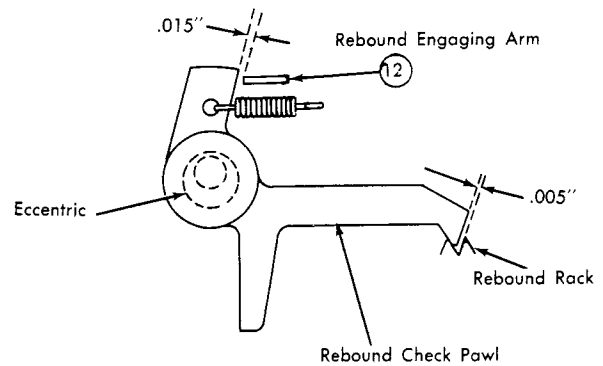


Figure 190. Rebound Check Pawl Engaged, with the Carriage Resting on a Tab Interposer

can be observed entering the rack. (Fig. 191).

11. The tab rack is to be adjusted forward or back until a latched out interposer can cover 1/3 to 1/2 of the exposed surface of a tab stop. The tab rack center support must be adjusted when making the tab rack adjustment. When setting a tab stop, it must not interfere on the interposer guide. Since the interposers stand at a slight angle when latched out, it is desirable to adjust the tab rack so that it, also, tilts back

12. The rebound engaging arm is to be adjusted so that, with the margin lever held to the extreme left, the rebound check pawl will clear the rack by .005" to .015".

13. The tab rebound check pawl is mounted on an eccentric stud so that it may be adjusted to engage a tooth of the rebound rack, under the tab rack, by .005" clearance (Figure 190). The adjustment must be observed when the set tab stop is pressed against the interposer and pushes the interposer guide to the left. The high point of the eccentric must be kept in the rear half of its orbit.

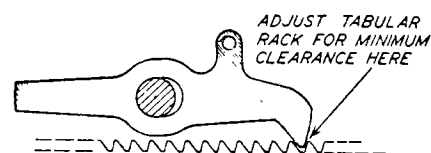


Figure 191. Tab Rack Lateral Adjustment

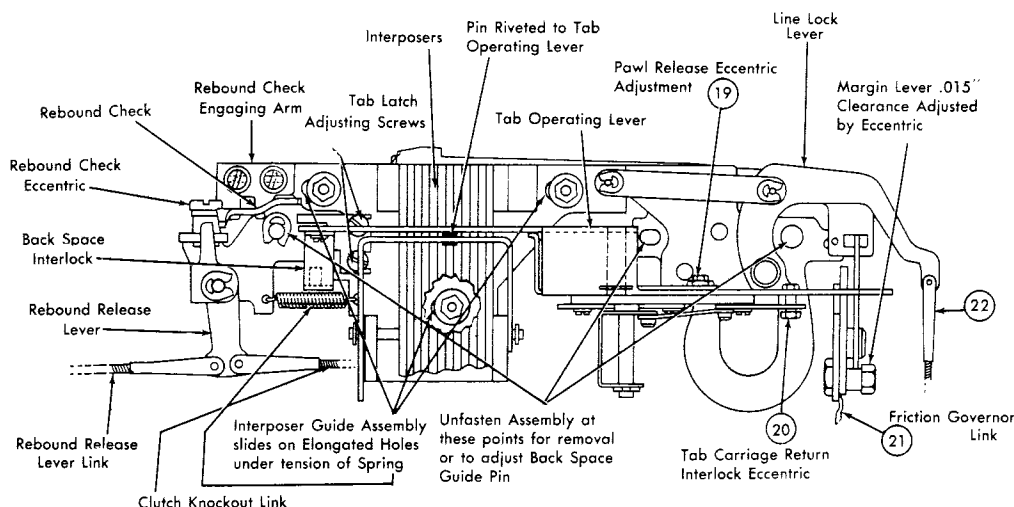


Figure 192. Decimal Tab Mechanism, Rear View

14. Make a check with the interposer guide on the rear rail pushed to the extreme left. The rebound check pawl should enter and bottom in the rebound rack. At that time there should be a clearance of .015" between the forward extension of the rebound check and the engaging arm (Figure 190).

15. With the interposer guide pushed to the extreme right and with the tab operating lever actuated, the rebound check should not strike on the interposer guide assembly (Figure 192). This would choke off movement of the actuating arm. No interference will result if the high point of the rebound check eccentric is kept to the rear.

16. The rebound release lever link runs from the intermediate lever, or carriage return bell crank, to the rebound release lever (Figure 192). The link should be adjusted so that, with the clutch latched, the tip of the rebound check pawl will just clear the rebound rack by approximately .010".

17. The clutch knockout link runs from the rebound release lever to the clutch knockout lever on the rear rail. The link should be adjusted to such a length that, with the clutch locked, the knockout lever will rise high enough to permit the margin stop to contact the inclined plane of the knockout lever about  $\frac{3}{16}$ " down from the top of the incline. The tip of the knockout lever should be formed upward to prevent the knockout lever from rising too high.

18. Adjust the tabular latch to the right or left until the tabular operating lever will latch by the thickness of the metal of the latch.

19. The pawl release lever must be adjusted, by means of the eccentric nut on the tab operating lever (Figure 192), so that the escapement pawl clears the rack by .005" to .015" when the tab operating lever is latched out.

20. The tabular-carriage return interlock must

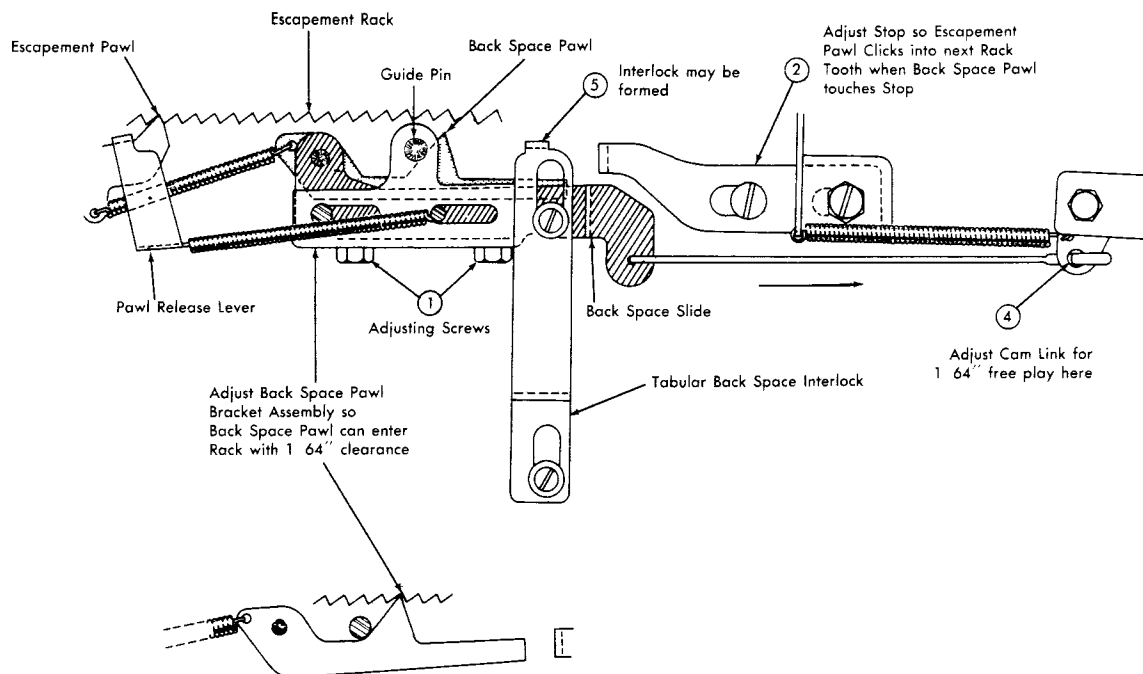


Figure 193. Back Space Mechanism for the Electric Typewriter with Decimal Tabulation

be adjusted by means of an eccentric (Figure 192) on the tab operating lever, so that the clutch knockout lever is held down during the time that the tab operating lever is latched out, but the tab operation is free of any binding action and that the tab operating lever is permitted to overthrow slightly as it latches. The clutch latching surface should be held to a minimum.

21. The friction governor link is to be adjusted to such a length that the friction governor pawl engages the teeth of the friction plate by the thickness of its own metal. If the link (Figure 192) is made too long, it will prevent the latching of the tab operating lever. The Executive governor pawl is used on this application.

22. The vertical link from the line lock lever is to be adjusted so as to permit the bell crank which it operates to have the most favorable leverage, or so that it pulls the bell crank at right angles to its lever arm (Figure 192).

23. The side link to the line lock bar should be adjusted to permit  $1/32$ " clearance between the key lever locking bar and the key lever locking hooks with the locking bar in its rest position.

Since the amount of slide motion in the tab lever assembly equals approximately two units, it is possible to tabulate to every second stop just as it is customary on former model machines.

#### Back Space

The back space mechanism is to be adjusted in the same manner as the standard back space mechanism.

1. Adjust the back space pawl bracket assembly on its elongated mounting holes so that the back space pawl can enter the escapement rack with  $1/64$ " clearance (Figure 193). In order to gain access to the back space pawl bracket mounting

screws, the tab lever operating bracket assembly may be backed away from the rail by removing the three screws on which the assembly is mounted (Figure 192).

2. The back space pawl stop must be adjusted on elongated holes so that when the back space pawl touches the stop, the escapement pawl will just click into the next tooth of the rack with approximately .010" clearance.

3. The back space cam is to be adjusted, by means of its stop, so that when the cam is tripped with the power off, the cam lug will drop just behind the non-repeat lug of the cam release lever.

4. The link from the cam to the bell crank under the rear rail should be adjusted so that the rear back space pawl link lies in place with 1/64" free play or clearance between the link and the operating edge of the hole in the bell crank.

5. The tab-back space interlock should require no adjustment unless it becomes damaged in some respect. The lug on the interlock is formed so that with the tab operating lever latched out, the back space pawl cannot touch the rack when the back space is operated.

The back space parts are designed so that the adjustments should hold indefinitely. In case of a malfunction of the back space mechanism, it is suggested that the parts be well lubricated and checked before the adjustments are changed. If a machine with decimal tabulation and a heavy carriage should occasionally back space more than one space at a time, it may be necessary to in-

crease carriage tension about one-half pound and set the link a half turn longer.

## LUBRICATION

In order to keep IBM Electric Typewriters in the best operating condition for customer satisfaction, and to aid in reducing service calls, it is very important that all moving parts be properly lubricated at regular intervals.

Lubrication involves the use of the correct lubricant applied in the proper amount, and at frequent enough intervals to prevent rust and excessive wear. Lubricants added in excess may flow or drip to parts which may be damaged by oil or grease. Insufficient lubrication will result in excessive wear and machine failure. Incorrect lubricants will be ineffective and may actually damage some parts. For example, oilite bronze bearings are porous and may become clogged and run hot if the wrong lubricant is applied. Decimal tab interposers will become sticky and will fail to restore if oil is applied in any form: finely powdered dry graphite is recommended.

The following lubricants are recommended for shop application as indicated in Figures 194 through 199.

	<u>Part No.</u>	<u>Quantity</u>
Porpoise Oil	1019500	1 qt. can
IBM Lubricant No. 6 (All-purpose oil)	260881	1 qt. can
Aero Shell No. 7	460011	1 lb. can
Shell Tellus No. 27	460010	1 qt. can
Shell Alvania No. 1 (All-purpose grease)	460021	1 lb. can

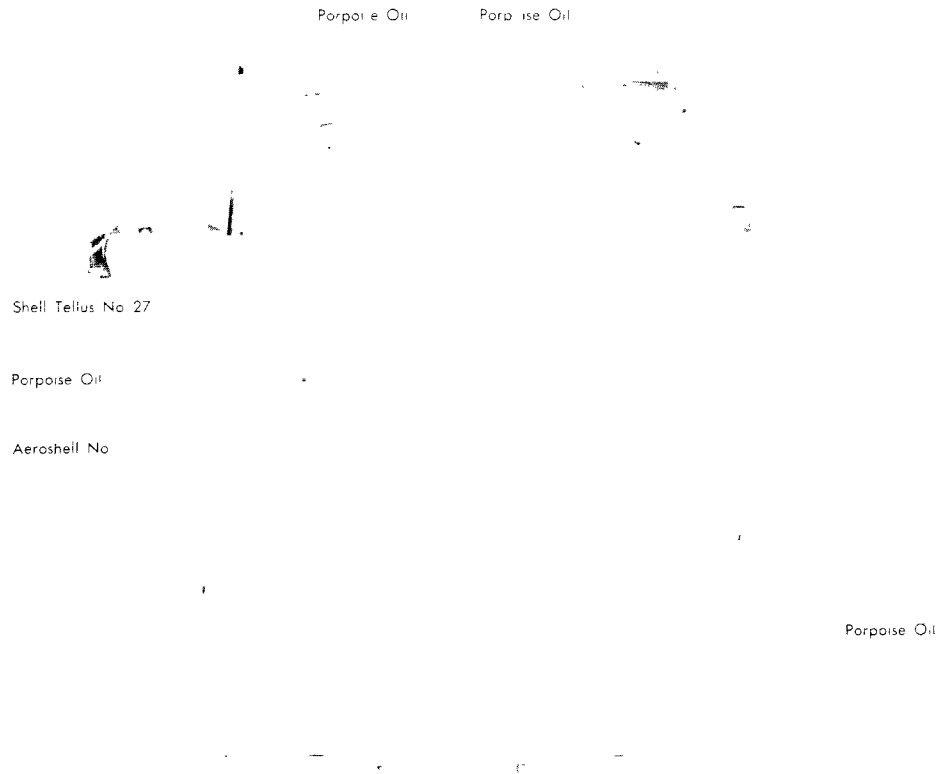


Figure 194. Lubrication Chart - Front

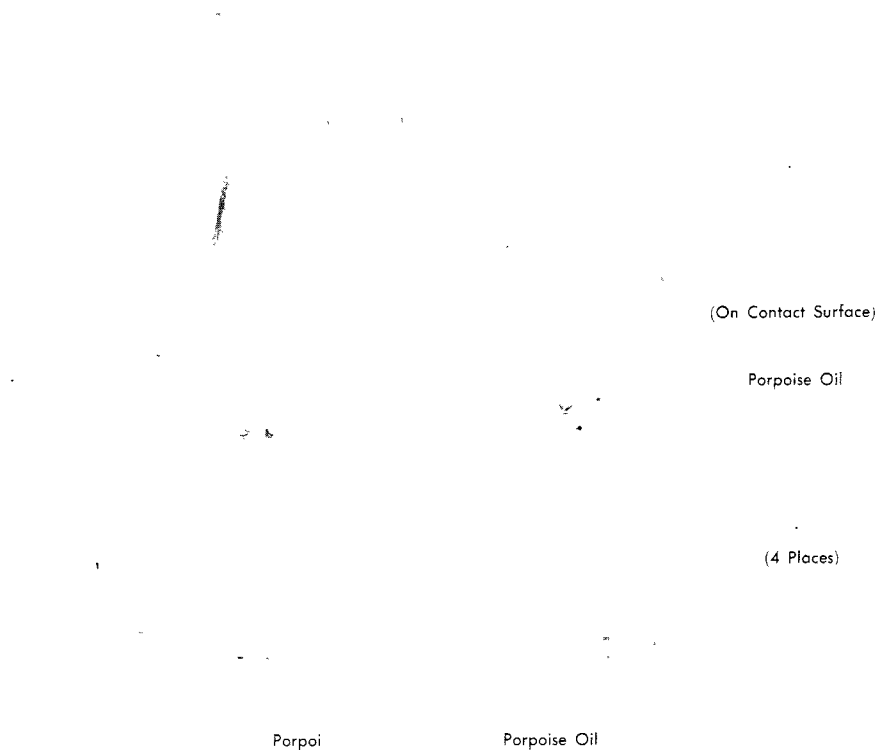


Figure 195. Lubrication Chart - Top

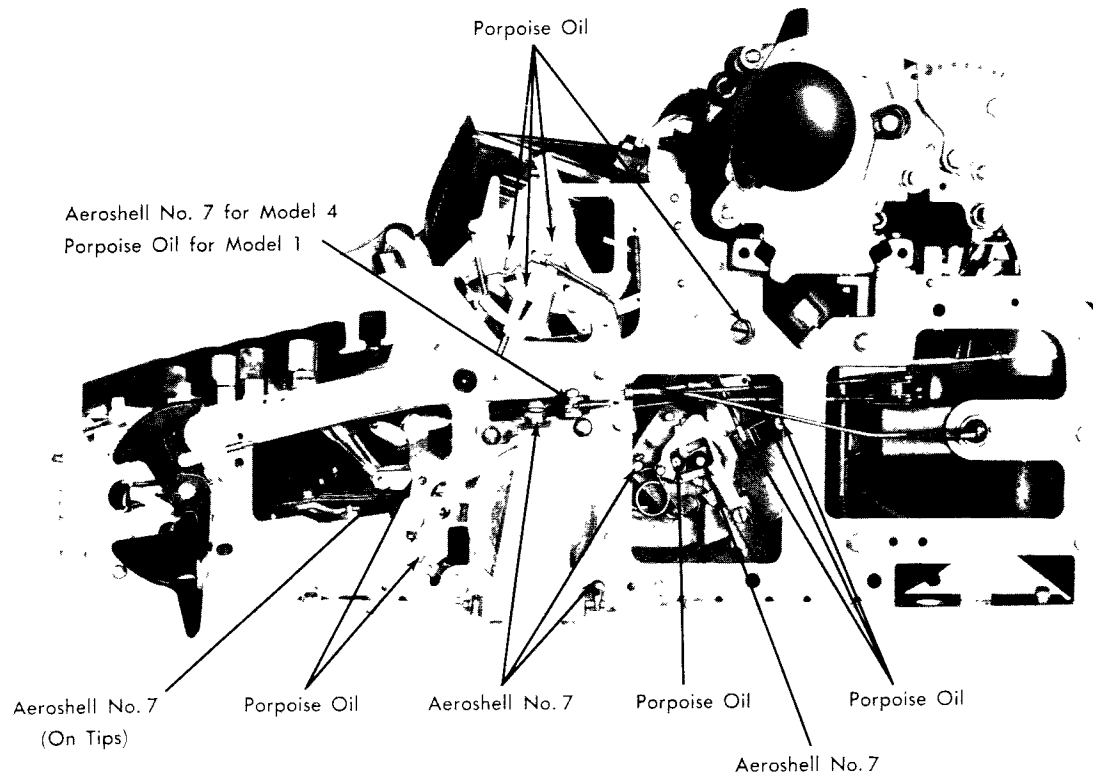


Figure 196. Lubrication Chart - Right Hand

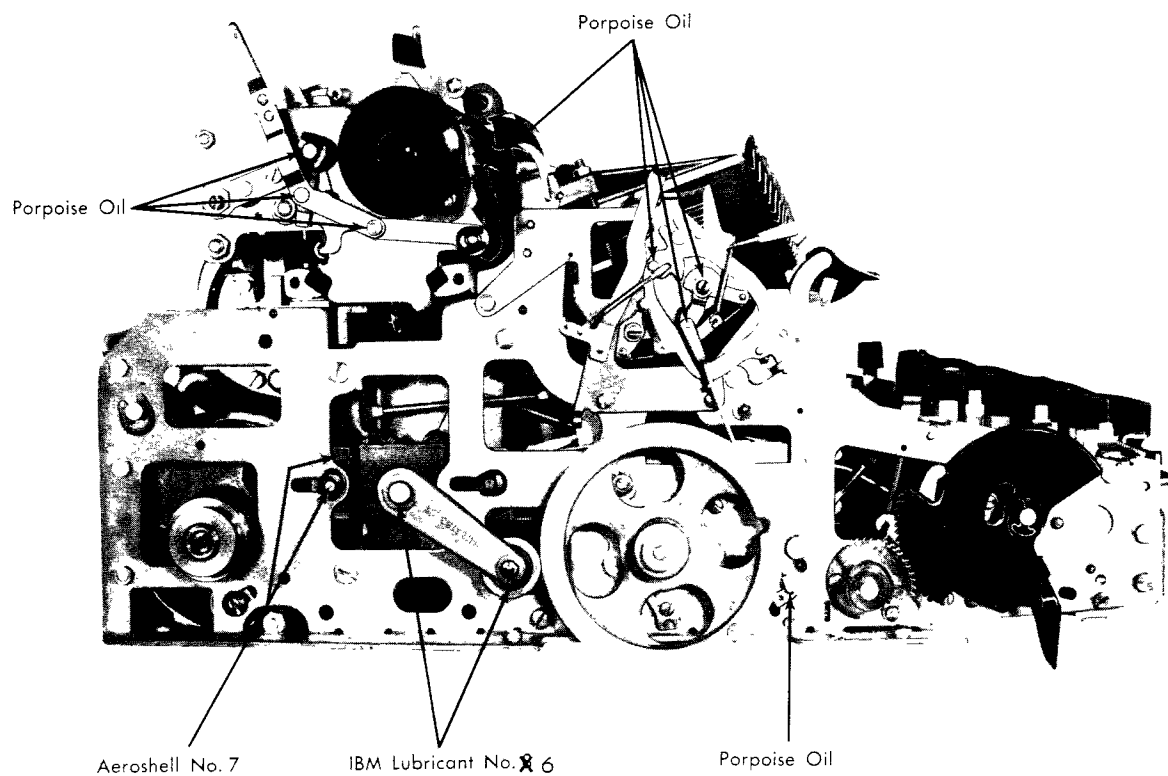


Figure 197. Lubrication Chart - Left Hand

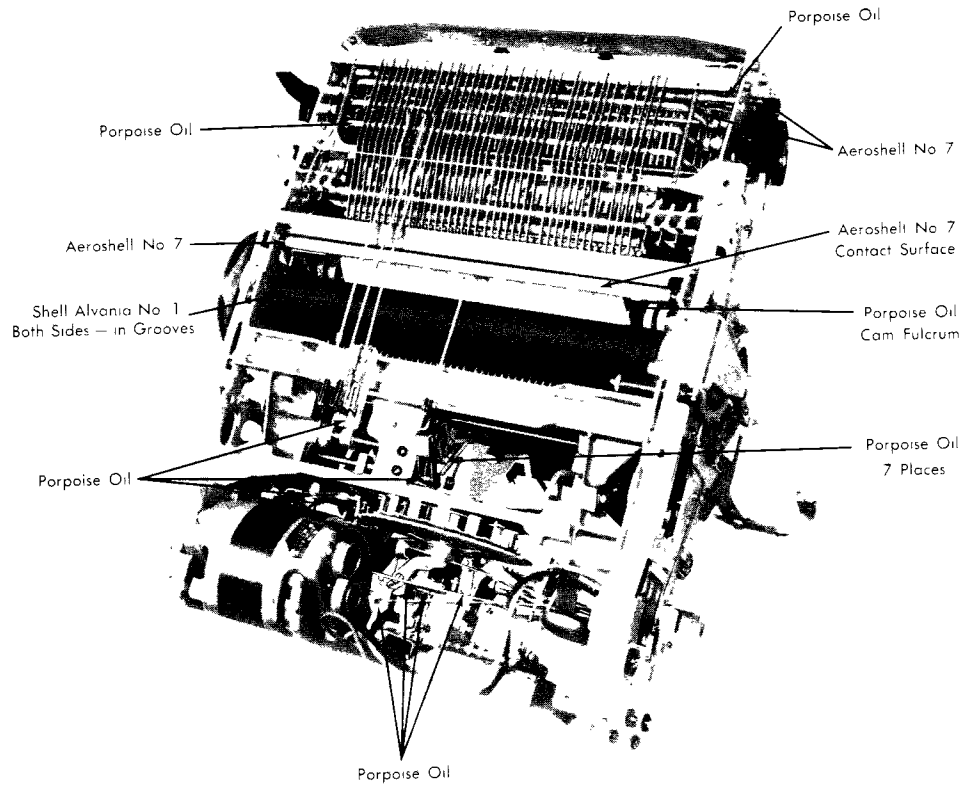


Figure 198. Lubrication Chart - Bottom

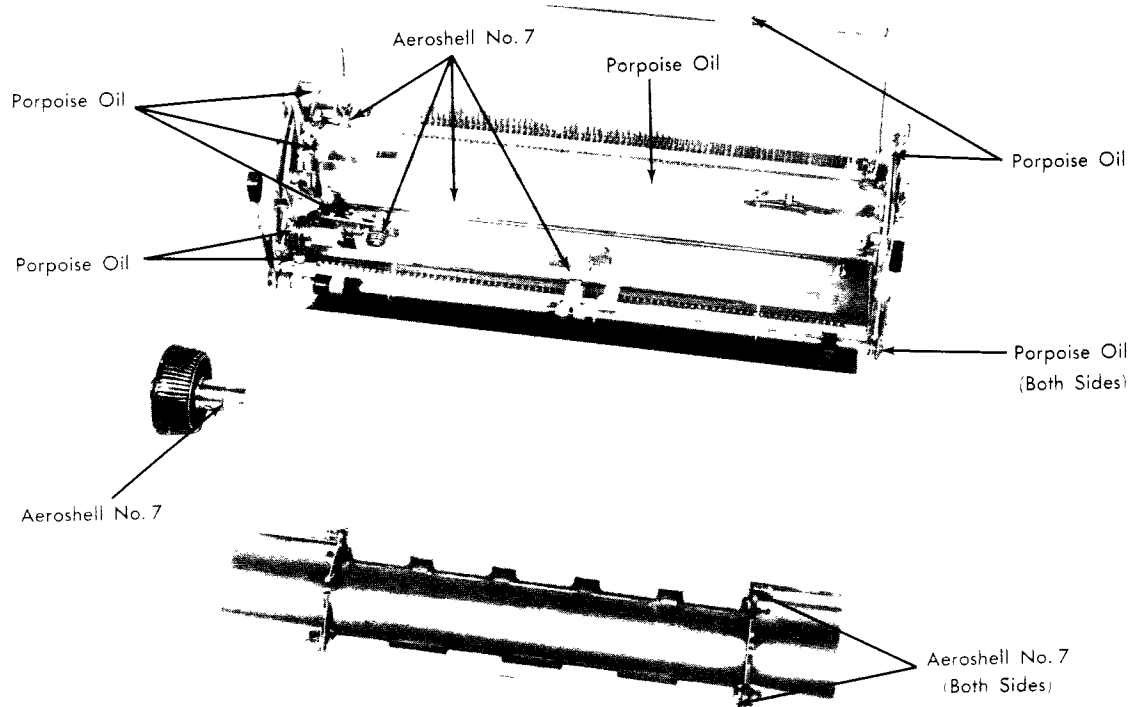


Figure 199. Lubrication Chart - Carriage Parts

The arrows indicate the major points to be lubricated during periodic maintenance. Some points such as pin clevises are not indicated because their movement is so slight that the original factory lubrication will generally be sufficient. However, during maintenance inspection any point which shows signs of wear or rust should be lubricated whether shown in the lubrication charts or not. Motors equipped with the oil return cup on the shaft should be oiled every six months. Motors without the oil return cup, every three months. Power rolls with the lubricating grooves in the shaft should be checked once a year. Power rolls without the lubricating grooves should be lubricated with IBM Lubricant No. 6 every six months.

Although the Model 4 typewriter was used as the model for the diagrams, the points to be lubricated are similar on all models.

The Model 6 Lift Platen Carriage will require additional lubrication at the following points:

Latch Shaft	Porpoise Oil
Platen Lift Linkage	Porpoise Oil
Guide Rollers	Porpoise Oil
Paper Feed Release Mechanism	Porpoise Oil
Latch Keepers - Lower Edge	Aero Shell No. 7

For convenience, it is recommended that the Customer Engineer carry one general-purpose grease, Shell Alvania No. 1, and one general-purpose oil, IBM Lubricant No. 6, for application on inspections and calls.

Before lubricating the typewriter during the periodic inspections, it is helpful to use a tool made of an old type bar to remove dirt which may have become packed in the segment slots. The feed rolls, bail rolls and platen should be cleaned with carbon tetrachloride. Carbon tetrachloride is toxic to some extent and should be used only in a well ventilated area and fumes must not be

inhaled for prolonged periods. The cams should also be cleaned because dirt and rubber become lodged in the serrations, resulting in cam slippage.

After cleaning, the typewriter should be lubricated as shown in the lubrication charts. The typewriter can then be checked to see that all functions operate properly. The procedure outlined for checking machines, page 9, should be used as a guide and a check list.

The inspection will require approximately forty-five minutes. During the functional check the Customer Engineer must concentrate his efforts toward the correction of conditions which might result in a future service call. By this practice emergency calls between periodic inspections will be greatly reduced.

## ATTACHMENTS

### Carbon Ribbon Attachment

A carbon ribbon attachment is available for use on the Model 1 Electric Typewriter.

A special ribbon center guide permits the use of either the 5/16" width carbon paper ribbon or the 9/16" width cloth ribbon now used on standard machines.

To install, remove the front case and top cover assembly, the ribbon corner guides, and the ribbon center guide. On machines with the removable power roll, remove the drive shaft release nut and the power roll driven pulley. On machines with the solid shaft power roll, the driven pulley may be used by providing a tapped hole in the center to accommodate a 6-40 thread screw to retain the rewind pulley on the driven pulley.

Two screws are provided for the upper holes in

the ribbon corner guides which are to be assembled between the cloth ribbon corner guides and the side frames.

The ribbon center guide is to be adjusted so as to lift, in the regular black ribbon position, to a height where the underscore will strike the ribbon approximately  $1/32$ " above the lower edge.

The power roll driven pulley, on machines with the removable power roll, is replaced with a similar part which has the mounting holes countersunk to prevent interference between the mounting screws and the rewind pulley. Three flat-head screws replace the original mounting screws. The rewind pulley is screwed to the power roll drive shaft in place of the release nut on machines with the removable power roll and is attached to the driven pulley by means of a screw on machines with the solid shaft power roll.

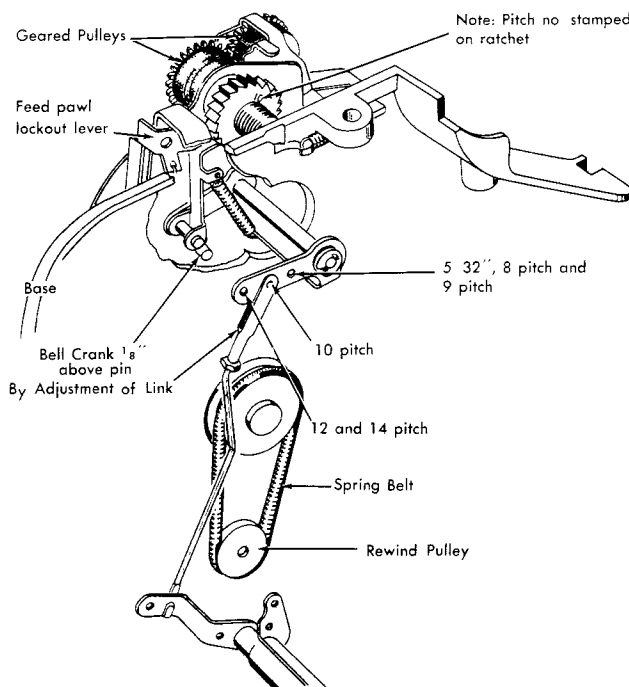


Figure 200. Carbon Ribbon Attachment

The escapement wheel is assembled to the square shaft of the ribbon feed pulley with the upper teeth pointing forward and held in place by the coiled compression spring and "C" clip. Care should be taken to avoid damage to the bronze bushing. The spring belt drives the rewind spool directly from the power roll shaft. The belt should be lubricated to prevent noise.

The hooked end of the ribbon feed connecting link is to be attached to the second hole from the end of the ribbon lift operating bail extension near the bottom of the left-hand side frame, as shown. The upper, or clevis, end of the link is to be connected in the hole nearest the end of the bell crank for a 12 or 14-pitch machine, in the center hole for a 10-pitch machine, and in the inner hole of the bell crank for a  $5/32$  pitch machine. The bell crank hole used for  $5/32$  pitch is also used for 8 and 9-pitch machines. In the rest position, the ribbon feed connecting link should be adjusted to hold the feed pawl bell crank approximately  $1/8$ " above the pin on which it rests. No other adjustments are required. Care must be exercised in adjusting the ribbon feed link because if it is too long, the pawl will strike the upper part of the magazine support and disengage the pawl.

It will be noted that the left-hand magazine plate incorporates a feed pawl lockout mechanism. When the ribbon is in the stencil position, the operator may move the feed pawl lockout lever toward the front of the machine to disengage the ribbon feed. The lug on the lockout lever is also for the purpose of preventing the feed pawl from falling below the ratchet.

The carbon ribbon mechanism has been designed so that the magazine covers can either be swung on their hinges or removed entirely. This design makes it more convenient for the operator to change ribbons on typewriters installed in well-type desks.

When removing the cover of a machine equipped with a carbon ribbon attachment, avoid stretching the ribbon drive spring belt which would result in failure to rewind ribbons completely.

The rewind spool pulley has been threaded to fit on a threaded shaft, locked in place by a nut. The serrated feed roller has been replaced by a rubber roller. This roller and the pressure roller are geared together to eliminate ribbon slippage as the ribbon passes between the rollers, thereby preventing the overlapping of characters and reducing the possibility of breaking the ribbon.

The two rollers are ground with a crown in order to insure that the ribbon will feed straight. However, the ribbon corner guide should be carefully aligned with the rollers to prevent the ribbon from feeding into the gears. This alignment should be rechecked whenever the front cover is removed, as it is possible to shift the cover slightly and change the adjustment.

For replacement purposes it will be necessary to use the following parts:

<u>Part No.</u>	<u>Description</u>
147297	Clip for 1074395
1074394	Feed Roller Assembly
1074395	Pressure Roller Assembly
1093694	Pressure Roller Arm Assembly

There were, at one time, two styles of ribbon lift guides available for field use, one for cloth ribbon and one for both cloth and carbon ribbon. These guides were connected to the lift lever by means of a link and a clevis spot welded to it. This has been reversed so that the link is spot welded to the ribbon lift guide and the clevis is adjustable.

The ribbon lift guides without the link can no longer be obtained. Therefore, for replacement

purposes one of the new ribbon lift guides, and a pin clevis, part No. 1070020 should be ordered.

#### Order on Parts and Supplies Requisition

<u>Part No.</u>	<u>Part Name</u>
1078535	Ribbon Lift Guide Assembly (Cloth Ribbon)
1078537	Ribbon Lift Guide Assembly (Carbon Ribbon)
1078561	Ribbon Lift Guide Assembly (Cloth and Carbon Ribbon)

It will also be noted that there are three styles of ribbon lift guide available instead of the original two.

#### Stroke Counter

Some installations require a method of counting the work done on the typewriter. Stroke counters are available in the ratios: 10-1, 100-1 and 240-1.

Typewriters with DC IBM motors will require a slightly different installation because of space requirements.

The stroke counter operating arm is connected to a hole in the escapement trip lever by an adjustable link so that each operation of the trip lever is registered. The connecting link should be adjusted so that, when a type bar is moved up to touch the platen and is restored to rest, a slight click may be heard as the detent operates inside the counter just before the type bar touches the type rest pad.

The stop plate should be set to limit the motion of the counter operating arm to prevent over-throw which might result in over-counting or counting too high. With the type bar held against the platen, there should be about .005" clearance, or the thickness of a piece of bond paper,

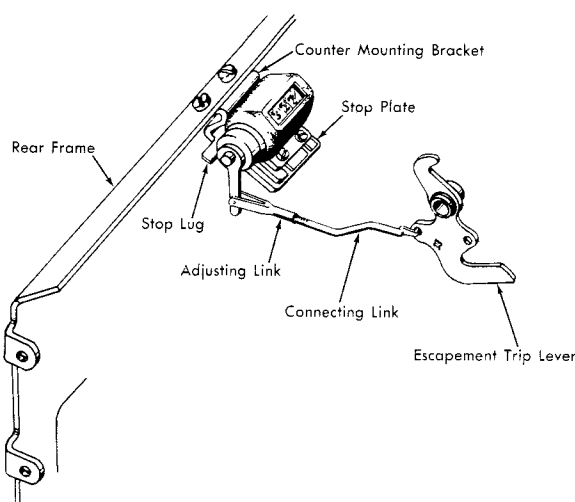


Figure 201. Stroke Counter

between the counter operating arm and the bracket stoplug. Several bars should be checked. A check should also be made for the same clearance with the space bar cam on its high point. Any change in the adjusted length of the escapement trip link must be compensated for by a corresponding change in the adjustable bracket stop plate, but the length of the link to the counter will not be affected by trip link changes.

The connecting link must be entirely free of binds, and the escapement trip link should float freely in position when at rest. The escapement tripping point for all type bars, in both upper and lower case, must be adjusted equally close to the platen to insure equal travel of the stroke counter operating arm. The section on adjustment of the standard escapement explains the proper adjustment. The space bar connecting link must be adjusted to move the stroke counter operating arm the same distance as when operated by a type bar stroke. The tendency will be for the space bar cam to drive the counter operating arm farther.

#### Check Writing Attachment with Powered Bail

This attachment provides a means of inserting,

locating and feeding a check or tabulating card in the IBM Electric Typewriter. In addition, the information being typed can be posted to a register sheet inserted around the platen, by having a sheet of carbon between the register and the check or card. The maximum recommended thickness of the combined forms is .022", when using the powered bail. Greater thickness would separate the gears.

The check writing attachment consists of a check holder attachment, which facilitates inserting and positioning checks or cards, and a positive vertical line spacing. The check holder attachment is available without the powered bail. This is recommended for single-line typing only. Both of these attachments are available for 12", 16" and 20" carriages.

An interchangeable left or right adjustable stop is provided with the check holder and may be located to permit the following horizontal positioning of the check or card with respect to either the left or right end of the check holder:

Carriage	Maximum Check Length	Horizontal Adjustment
12"	9-7/8"	1-3/16" to 3-3/16"
16"	12-7/8"	1-3/16" to 5"
20"	17-7/8"	1-3/16" to 5-1/4"

The check holder may be adjusted vertically to position the first writing line in any position from 1-7/16" to 2" from the bottom of the check or card.

Installation of the check writing attachment with the powered bail requires removal of the platen, deflector and feed roll assemblies, actuating shaft, front paper scale and spring, dust cover, carriage end covers, carriage tie rod, bail levers and spacers, bail shaft, front case section, ribbon feed assembly side plates, and line gage card holders.

It is necessary to cut away portions of the front case section, the ribbon feedplates and the side frames to provide the necessary clearance for the check holder. The cuts can be made with a fine hack saw and all edges smoothed with a file. Cut surfaces should be touched up with gray paint. If special ribbon feed plates have been provided, the plates need not be cut.

Install the line gage card holder and bracket in place of the front rail dust cover (Figure 203). Install the checkholder and the adjustable check stop on the new front paper scale, using screws and speed nuts. The screws should be drawn up snugly without preventing the holder from being moved manually.

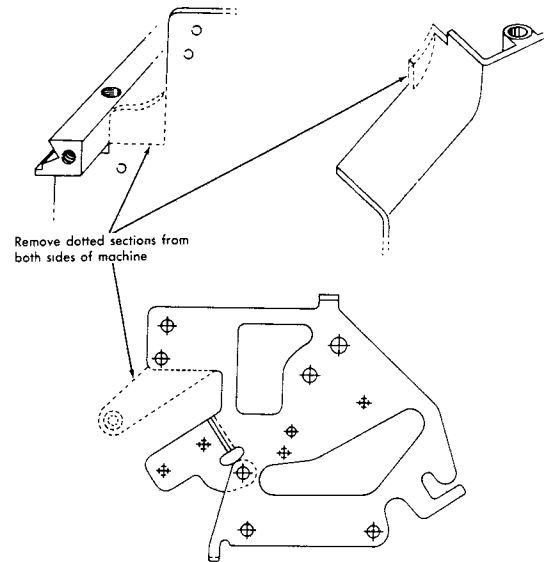


Figure 202. Sections to be Removed

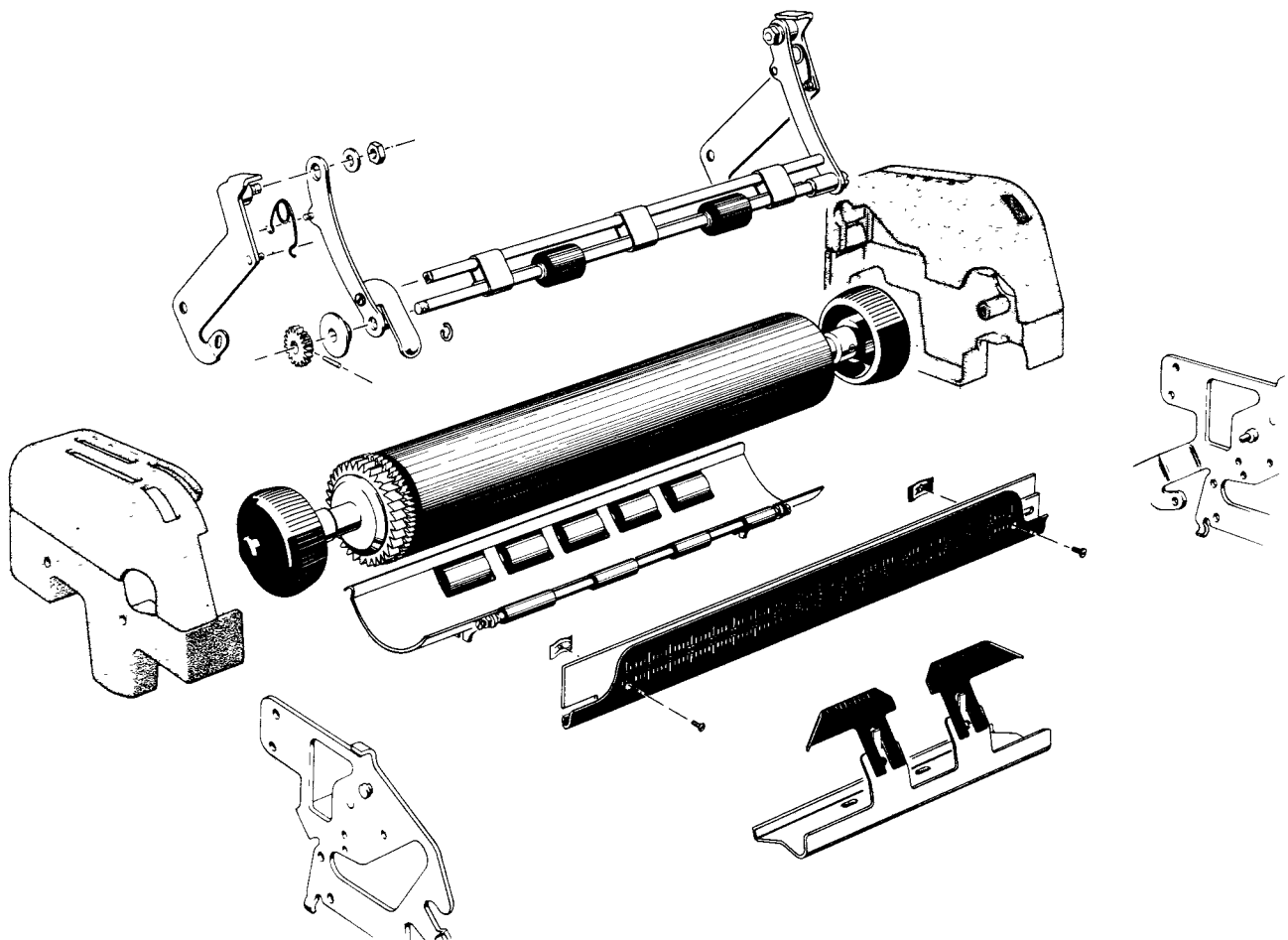


Figure 203. Check Holder and Powered Bail Assembly

Install the check holder on the actuating shaft, using the spring and collars. If special ribbon feed plates have been provided, transfer assembled parts from the old plates to the new plates and mount the assemblies on the frame, using nuts and longer screws through the ribbon corner guides. Install new carriage end covers.

Install the special deflector and feed rolls assembly and the special platen. The special platen is not interchangeable with standard platens because the platen rubber has been cut back from the left edge to permit the hub to lie in a groove beside the ratchet.

Mount the bail arm brackets so that the holes fit over the bail arm studs and the paper table positioning bracket stud, using the washers and nuts previously removed. Mount the geared bail shaft and levers on the brackets, using washers and nuts. Adjust the bail arm brackets to locate the bail rolls just high enough to clear the type heads with the shift in lower case position. Install the front case section.

The bail assembly should be free of binds and its torsion springs should bring it down sharply on the platen to insure proper meshing of the gear teeth. Moving parts should be lubricated with IBM Lubricant No. 6.

#### Check Holder Only

If it is desired to install the check holder only, and use the conventional paper bail instead of the powered bail, remove the deflector and feed rolls assembly, the actuating shaft, the front paper scale and spring, the dust cover, the ribbon feed plates and the front case section. Follow the instructions for installing the check writing attachment through "Install the Special Deflector and Feed Rolls Assembly".

#### Pin Feed Platen Assembly

The pin feed platen provides a means of feeding multiple-copy forms, with interleaved carbon, through the machine and maintaining register between the copies. Perforations along the edges

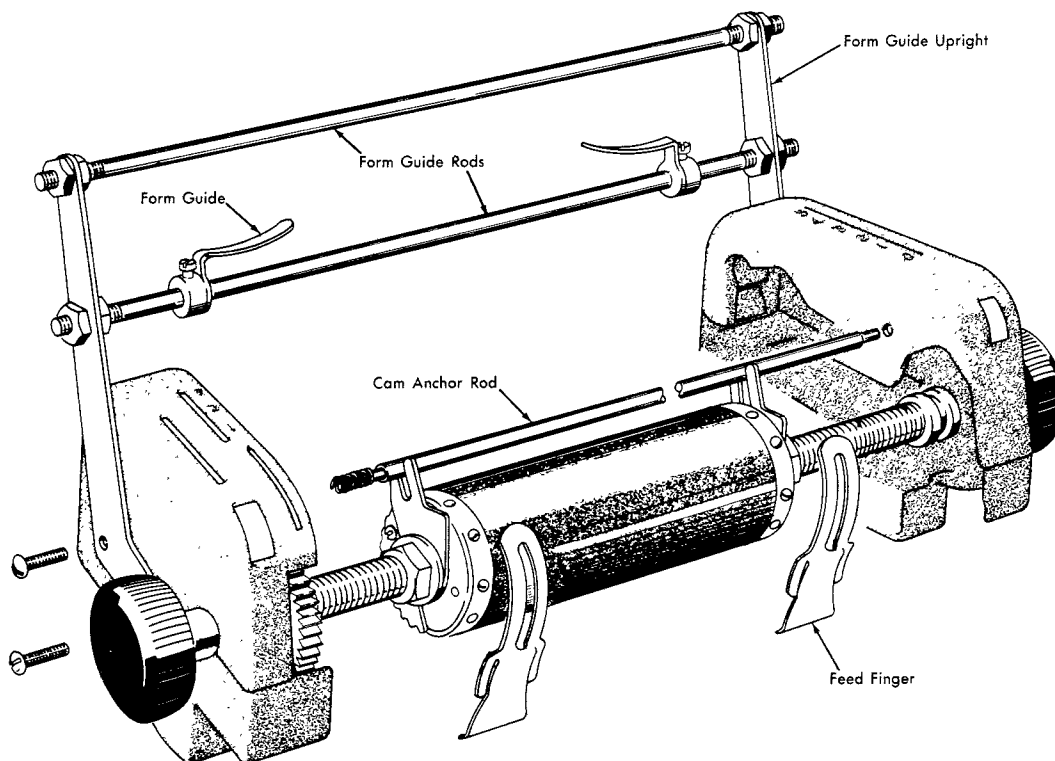


Figure 204. Pin Feed Platen Assembly

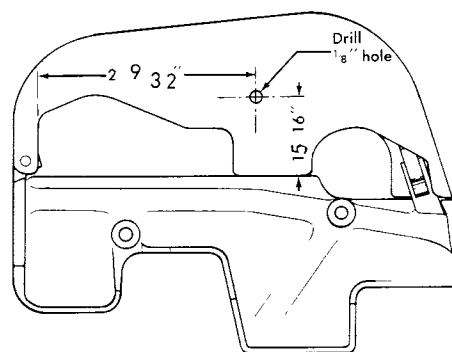
permit retractable pins in the rims of the platen to pull the form as the platen is rotated. The feed fingers, which are sprung into place on the front paper scale, hold the forms against the platen rims so as to keep the perforations on the pins.

Platen cylinders are available in three grades of hardness, rated soft, medium and hard. These grades compare with platen hardness grades numbered 1, 2 and 3, respectively. Each of these grades of hardness is available in different lengths, measured between the pins, including 5-1/4", 6", 7-1/2", 8", 9-3/8" and 9-7/8". Platen cylinders may be replaced by removing the right-hand platen knob, platen bushing and the hex nut against the right-hand pin wheel assembly (Figure 204). The right-hand pin wheel assembly may then be removed from the shaft. The two hex nuts lock the cylinder on the shaft in any position desired with regard to center.

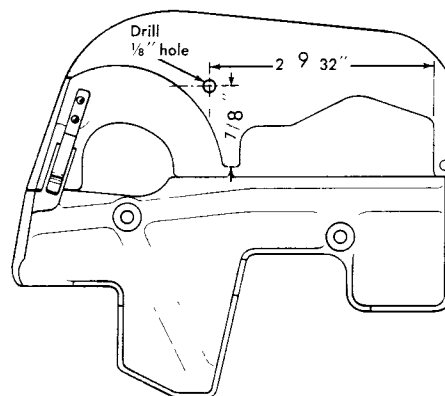
Platen ratchets are available with 33, 44, 55 and 66 teeth to provide line spacing as indicated in the chart in the Ratchets and Detent Release Section. The platen ratchet is adjusted to proper registration for the form in use by loosening the setscrews and turning the ratchet to the desired position. The setscrews must be tightened securely to hold the ratchet in place.

The position of the pins may be adjusted by loosening the round-head screw in the slotted opening of the locating plate and rotating the plate until the pins begin to protrude as they reach the top of the front paper scale and begin to retract just before leaving the slot in the feed finger. Rotate the platen backward to insure that the pins do not catch on the top of the front paper scale.

Installation may be accomplished with little alteration. The carriage end covers must have holes drilled to accommodate the cam anchor rod (Figure 205).



Carriage End Cover R.H.



Carriage End Cover L.H.

Figure 205. Holes in Carriage End Covers

During operation, the feed roll release lever is held forward in the released position because the feed rolls are not required to feed the paper. To insure that the release lever will remain in position, a detent spring should be attached by means of the nut on the left-hand end of the carriage tie rod, and the screw that locks the left-hand platen guide shaft bearing plate (Figure 206).

#### Palm Tabulation Attachment

This attachment provides a means of operating the tabular key with the palm of the hand as well as with a finger on the tabular key button. Installation may be made by removing the key plate, front frame, space bar key lever, tab key lever, and by removing the space bar stop bracket from the front frame.

Attach the palm tab key guide to the new front frame by means of the two key guide screws.

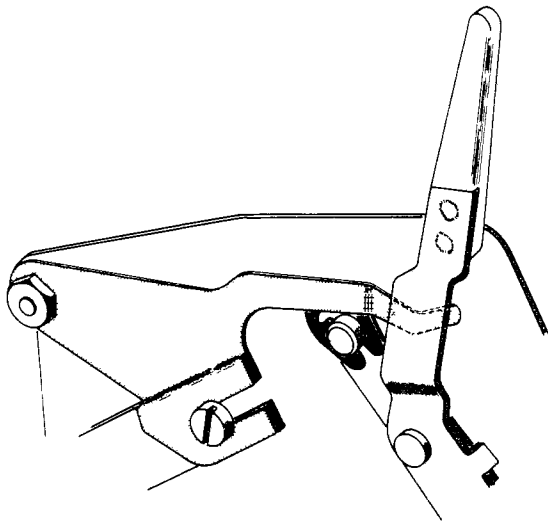


Figure 206. Detent Spring for Feed Roll Release Lever

Install the bumper on the palm tab key. Pass the palm tab key through the key guide from the bottom.

Attach the spring from the palm tab key to the key guide and install the palm tab key extension on the palm tab key, using the key extension screws. Install the new space bar key lever and install the old space bar on the new key lever. Install the new tab key lever and install the new palm tab assembly, passing the space bar equalizing rod between the palm tab key and the key guide. Replace the space bar stop bracket.

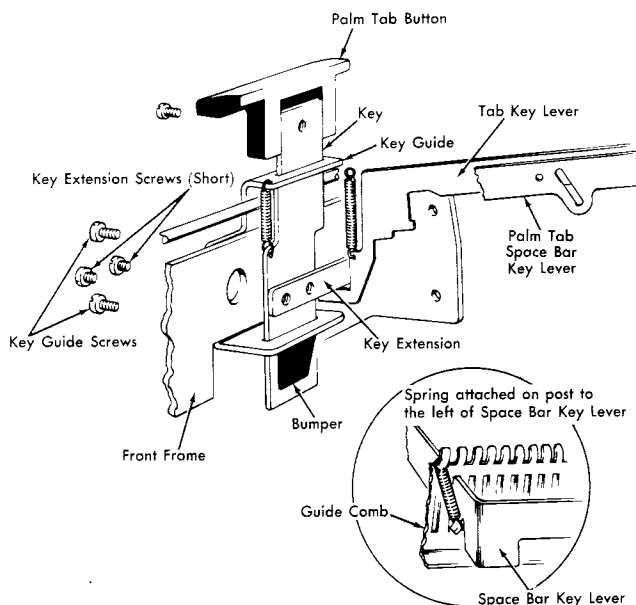


Figure 207. Palm Tabular Attachment

Attach the cam release links to the space bar and tab key levers. The long slot in the space bar key lever and the two lugs on the tab key lever are not used for the palm tab attachment but are the result of standardization of parts.

Install the palm tab key plate and the palm tab key button.

Adjust the tab and space bar cam release links so that the cams will trip when the respective keys are depressed  $2/3$ . Use the tabular key for testing the tab cam release.

Adjust the palm tab key guide in its elongated holes to align the key button in the key slot. Adjust the palm tab key extension up or down in the elongated slot so that the tab cam will be tripped before the tab key extension strikes the guide. Adjust the key button in its slot so that it will not strike the key plate when depressed.

#### Card Holding Platen

The card holding platen has been designed to accommodate cards so that the operator may more easily type near the edge. A metal insert provides an opening which receives the card and an adjustable stop provides the operator with a means of locating cards at the correct typing position.

The stop is adjusted by sliding it on the metal strip on the platen. It may be used on the left or right side at the convenience of the operator.

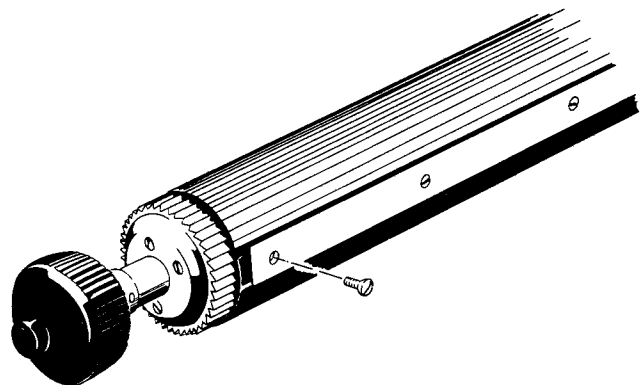


Figure 208. Card Holding Platen

## TYPING MATERIALS

### CARBON COPIES

The results obtained from the typewriter are directly related to the materials used to produce those results. The IBM Electric typewriters, because they have eliminated the operator's touch as a factor in typing, can accept a greater range of difference in typing materials. This section is intended to acquaint the reader with some of the various typing materials, with a view to suggesting the best combination for general application. It is not the purpose here to itemize products by brand name, but rather, it is proposed that materials available locally be utilized to their best advantage within each application.

The number and legibility of carbon copies, for example, can be influenced by six major factors, with fifteen subdivisions, in addition to machine adjustments. These are listed in the order of their relative influence on the result.

#### Carbon Copy Paper or Manifold Tissue

Paper used for carbon copies should be judged according to finish and weight. Papers best adapted for multiple copy use are those which will accept carbon deposit readily. Papers ranging in weight from 16-pound down to 7-1/2-pound manifold will find a place in multiple copy work. The thinner or lighter the paper, the more copies can be made. Paper for carbon copies often has a shiny, smooth surface on one side only. The opposite side will present a better texture to which the carbon will adhere.

The finish of carbon copy paper will fall in one of three classifications: glazed, smooth and cockle. Glazed finish has two distinct advantages in that it permits typing a greater number of

legible copies and is not receptive to feed roll marking. Glazed paper has the disadvantages of producing a minimum evenness of impression color and it is harder to handle, both in assembling forms and in stripping the carbon out of the forms when typing is finished. The glazed finish is so fine that the sheets set up a static attraction with the other parts of the form and tend to cling. It is recommended for the greatest number of copies.

Smooth finished copy paper will permit about 15 percent less copies and can show feed roll marking easier but it has a much more uniform appearance and handles more easily than glazed paper.

Cockle finish has a rippled appearance and is the easiest to handle. It shows little or no feed roll marking but its legibility of write is not as good as that of the other finishes.

The rippled finish permits the build-up of air pockets between the copies and assists in separating the sheets from the carbon. These pockets can become so deep in the accumulated form of several copies, that the type face becomes buried in the cushion thus created and underprinting can result. Flat finished paper has a decided advantage in making a large number of copies. A form of many copies may require that the first copy be tougher than the balance of the form in order to protect the original sheet from the cutting of the type faces.

#### Carbon Paper

Carbon paper is judged by its weight and by the intensity of the finish. The thickness of paper

used in making carbon paper usually varies from 4-pound, light weight, to 7-pound, medium weight, to 10-pound, heavy. Light weight paper is better suited to building up a large number of copies and promotes greater legibility in the final copy. The finish varies from intense to medium to hard, with the intense finish depositing more carbon at each impression. Intense carbon paper may be found objectionable for some applications because a greater deposit of carbon can smear more readily, feed roll marking may become objectionable, the impression will not be as sharply defined and the carbon paper cannot be used as many times as can a harder finish carbon paper. Hard finish carbon paper deposits a little carbon at each impression and maintains the design of the letter more accurately. Because the impression appears lighter or grayer than other finishes, hard carbon paper copies are sometimes judged indistinct when, in reality, they hold more detail than those of intense carbon paper.

A form made up of several parts may require that the first sheet of carbon paper behind the original sheet be tougher or heavier than that used for the balance of the form in order to back up the original sheet and protect it from cutting by the type. A heavier first carbon will also last longer.

The following table lists part numbers for various weights, grades and sizes of IBM carbon paper.

<u>Weight</u>	<u>Finish</u>	<u>Size</u>	<u>Code</u>	<u>Part Number</u>
4 lb.	Intense	8-1/2x11-1/2	611	1023565
4 lb.	"	8-1/2x13-1/2	611	1023566
4 lb.	"	8-1/2x14-1/2	611	1023567
7 lb.	"	8-1/2x11-1/2	641	1023568
7 lb.	"	8-1/2x13-1/2	641	1023569
7 lb.	"	8-1/2x14-1/2	641	1023570
10 lb.	"	8-1/2x11-1/2	651	1023571
10 lb.	"	8-1/2x13-1/2	651	1023572

<u>Weight</u>	<u>Finish</u>	<u>Size</u>	<u>Code</u>	<u>Part Number</u>
10 lb.	"	8-1/2x14-1/2	651	1023573
4 lb.	Medium	8-1/2x11-1/2	613	1023574
4 lb.	"	8-1/2x13-1/2	613	1023575
4 lb.	"	8-1/2x14-1/2	613	1023576
7 lb.	"	8-1/2x11-1/2	643	1023577
7 lb.	"	8-1/2x13-1/2	643	1023578
7 lb.	"	8-1/2x14-1/2	643	1023579
10 lb.	"	8-1/2x11-1/2	653	1023580
10 lb.	"	8-1/2x13-1/2	653	1023581
10 lb.	"	8-1/2x14-1/2	653	1023582
4 lb.	Hard	8-1/2x11-1/2	615	1023583
4 lb.	"	8-1/2x13-1/2	615	1023584
4 lb.	"	8-1/2x14-1/2	615	1023585
7 lb.	"	8-1/2x11-1/2	645	1023586
7 lb.	"	8-1/2x13-1/2	645	1023587
7 lb.	"	8-1/2x14-1/2	645	1023588
10 lb.	"	8-1/2x11-1/2	655	1023589
10 lb.	"	8-1/2x13-1/2	655	1023590
10 lb.	"	8-1/2x14-1/2	655	1023591

The Carbon Paper Code consists of three digits. The first distinguishes the carbon paper from former types. The 6 type has two diagonally opposite corner cuts for easy removal, an anti-curl finish, back surface treated to prevent slippage and to provide ease of stripping, and each size is 1/2 inch longer than its mating paper size to provide greater ease of handling and greater usage. The second digit indicates the weight of the paper: 4 lb. - 1; 7 lb. - 4; 10 lb. - 5. The third digit indicates the degree of hardness of the finish: Intense - 1, Medium - 3 and Hard - 5. The code and part number should be used on all orders. Each box holds 100 sheets.

#### Type Face (Effect on Copies)

The number of carbon copies to be obtained is influenced largely by the size and boldness of the

type face and the severity of its design. Large, plain type faces with little or no boldness can carry an impression through a greater thickness of form and produce more copies. Anything that detracts from these advantages, reduces the number of legible copies to be obtained.

#### Platen (Effect on Copies)

The hardness of the platen directly affects the number of legible carbon copies in that, as the number of sheets increases, the cushion effect is also increased. Consequently a more firm backing, in the form of a harder platen, is required. The limiting factor is that a hard platen induces type cutting. The diameter of the platen also affects the number of carbon copies indirectly. As the number of copies is built up, the diameter of the combined platen and form is increased until the proper ring and cylinder relationship is lost. A smaller diameter platen is required when using a multiple copy form.

There are instances which require that the machine be used for two or more quite different applications where different platens should be used. A certain amount of leeway may be taken with the standards, for both of the different applications, to permit using only one platen, but there are limitations beyond which it is not advisable to try for top performance without changing platens. It would be profitable to recognize this point early to avoid wasting service time. In fairness to customers, they should be informed at the outset if a double application requiring more than one platen, rather than to endure inferior results in an attempt to use only one platen beyond its limitations.

#### Fabric Ribbons

Ribbon, by its inking, its thickness or caliper, its thread count and the material used in the ribbon, will have little effect on the number and

quality of carbon copies. These factors will have a direct bearing on the appearance of the original and possibly the first two or three carbon copies as far as embossing is concerned. Ribbons will generally be chosen for qualities of ink and fabric life and appearance of the original sheet.

The effect of ribbon on the carbon copies is actually two-fold. First, it should be understood that the thicker ribbon can act in two different ways. It may protect the original from being cut by the type face and thus help produce more copies by permitting a higher setting of the impression control. The thicker ribbon might also destroy some of the detail of the copies obtained because of the additional cushion it helps to produce around the type face. Either of these effects would be noticeable but not major. The reason for using a heavy caliper ribbon would be to obtain a longer fabric life, a longer ink life of the ribbon, and to keep cutting of the original to a minimum.

A good ribbon must be made from long, tough fibers to render it resistant to the cutting action of the type. The yarn from which it is woven must have a slightly loose, rather than a tight twist, for the same reason, and also, to insure that the ribbon will absorb a maximum of ink.

The finish is important and must include washing, bleaching and singeing to remove fuzz and lint. The thread count must be high to accommodate more ink and to provide longer wear. The thickness of the ribbon is also a wear factor, for if the ribbon is too thin it will be more easily cut by the type.

The proper inking of the ribbon shows good contrast with the paper and permits easy erasure. Good ink minimizes type filling and smeared impression.

The longer fiber, looser twist, balanced thread

count and higher grade ink combine to improve another quality which is indispensable in a good ribbon, that is the ability to re-ink itself from the portions outside the part actually struck by the type. As the ribbon is wound from one spool to the other it absorbs ink by capillary attraction so as to cause the ink in the ribbon to be used more evenly and eliminate dry spots. Oil must be kept off the ribbon, as it may cause spottiness.

The ribbon must be supplied on the correct spools to guarantee proper operation of ribbon feed and reverse. Any ribbon purchased in an IBM box will be on an approved spool. IBM fabric ribbons are 9/16" wide and 14, 16 or 18 yards long, depending on the caliper. Ribbon dealers, in some cases, supply other brands of ribbon for our machine in 12 yard lengths, which is standard for the manual typewriters. Manual typewriter ribbons are only 1/2" wide. The extra width in IBM ribbons provides a greater reservoir of ink and permits two track write for large size types.

The selection of the proper ribbon for an application will depend basically on the type face. It is recommended to use 40 inking ribbon with Elite type or smaller, 50 inking ribbon with Pica type or any type of similar size. Types larger than Pica, such as Pica Gothic type or any type of similar size, call for a 60 inking ribbon in the heavy duty classification. Individual preference will play a great part in the choice of a ribbon for any type used as a base from which to work. Refinements in the selection of a ribbon will be indicated by the sharpness of write, permanency of impression, ease of erasure, durability of the ribbon and graduated wear of both fabric and ink life. Some customers may choose heavier inking ribbons to obtain longer ink life and sacrifice cleanliness of write until some of the ink has been used out of the ribbon.

Another factor in selecting the proper ribbon for an application, especially where appearance of the result is concerned, is the kind of paper being used. Lighter inking ribbons should be used for hard, smooth or glazed papers so as to minimize smudging.

### Nylon Ribbons

Nylon ribbons present a stronger fiber, longer ink life and longer fabric life than any other ribbons. They are available in two grades which differ in ink formula and caliper or thickness. Because the nylon fibers are of synthetic manufacture, they can be maintained at a uniform diameter, resulting in a more uniform caliper throughout. This means longer ink life and fabric life of the ribbon. The edges of the nylon ribbons have been slit with hot cutting knives which have the effect of sealing or bonding the edges to prevent fraying. The caliper of the ribbon is designed to reduce embossing to a minimum and the nylon ribbons will withstand punishment for a longer period than will other ribbons. However, if an 8 or a 3 platen is used in writing on a single sheet of paper, with the impression control set heavy, the type face may cut through nylon ribbon as well as any other fabric. The following chart indicates recommended uses for nylon ribbons. Individual preference may vary slightly from these recommendations.

Superior Write Nylon, Black, .003" caliper, produces the cleanest write of any fabric ribbon and can be used with any type face except Copperplate Gothic or Proportional Bold Face.

### Recommended Uses

Inking	Standard ET	Executive ET
30	14 & 16 pitch type	See Note
40	12 pitch type	Most type faces
50	10 pitch type and larger	See Note

NOTE: No. 30 and No. 50 Superior Write Nylon ribbons are available for Executive type faces if the individual preference indicates a lighter or heavier impression.

Superior Life Nylon, Black. .005" caliper, provides a heavy duty nylon ribbon. Due to its heavier caliper it is not recommended for use with any of the Executive type faces.

Inking	Standard ET	Executive ET
40	12 pitch type	Not recommended
50	10 pitch type	Not recommended
60	All types of Gothic, 10 pitch 9 pitch, etc.	Not recommended

The ink used in the nylon ribbons has a slight amount of blue toner which is used to insure maximum legibility as the ribbon approaches the end of its ink life and provides a richer looking color.

#### Silk Ribbons

IBM silk ribbons provide clear, sharp impressions. A 40 inking silk ribbon is recommended for use on Elite and similar types while all inkings may be used on Pica and larger types. The lighter the inking, the sharper the impression and the heavier the inking, the greater the durability. It may be expected that, due to the thinner caliper of the silk ribbon .003", that the original may be embossed a little more than with a heavier caliper ribbon.

#### DeLuxe Ribbon

The DeLuxe ribbon is the name given to a high grade, high thread count, cotton fabric ribbon of .0035" caliper, designed to produce sharp, uniform impressions on any fabric ribbon job. A 40 inking ribbon is recommended for Elite and smaller types and all inkings for Pica and larger types. The heavier the inking, the

longer the ribbon may be used before losing its density of impression. However, the characters will be somewhat broader in appearance. The DeLuxe Executive ribbon formerly carried is replaced by Superior Write Nylon Ribbon.

#### Standard Ribbon

Made from high quality cotton fabric of .004" caliper, the Standard ribbon has a slightly lower thread count per square inch than the Executive ribbon. Type impressions with a standard ribbon are not quite as sharp as work from Silk or Executive or Nylon ribbons. The Standard ribbon can be recommended for general office work, using No. 40 inking for Elite and other small types and all inkings for Pica and larger types.

#### Heavy Duty Ribbon

Made from a strong, heavy fabric of .0063" caliper which limits the cutting action of the type, the Heavy Duty ribbon has strong absorbent qualities and should be recommended when the sharpness of print is not a governing factor but when greater durability is desired, such as billing or manifold applications. However, since it is true that the thickness or caliper of a ribbon affects the legibility and sharpness of carbon copies, it might be well to suggest the use of Standard, Executive or Nylon ribbons on very heavy manifold work. The Heavy Duty ribbon is furnished in several degrees of inking but the No. 50 is suggested. The use of any lighter inking detracts from its durability. The heavy fabric in this ribbon helps to overcome the embossing of the original and the first sheet of carbon paper.

#### Hectograph Ribbon

This is a cloth ribbon, impregnated with hectograph ink for preparing positive masters used

in gelatine process duplicating. These ribbons are inked on one side only which cuts down on the filling of type faces. A light inking, 45, is recommended for use on machines equipped with Elite or smaller type. A medium, 55, inking is satisfactory for Pica type. When Pica Gothic or larger type is used, or when a great number of copies is required, it may be necessary to use a more heavily inked ribbon, 65.

### Papers

Paper, to be used as the original sheet in a form, should be tough without being brittle so that it will resist any cutting action of the type face, even when the impression is set heavy to make a number of copies. The original sheet must not be heavy, however, because an exceptionally heavy sheet would prevent the type impression from reaching through to the last copies. Generally, any case of type cutting the original sheet will be confined to only three or four characters. These characters can be taken care of individually much more readily than to condemn the customer's paper, platen, typewriter or operator.

Papers consist of the pulped fibers of cloth or other fibers which bond themselves together during the process of being beaten into tiny fragments and mixed with great volumes of water. The Chinese, in the first century, are reported to have made paper in this manner, working with a mortar and pestle and using scraps of silk, linen and fish nets. Paper was made by hand in this country prior to the introduction of the paper-making machine in 1827. The principle of its operation is to form a wet web of paper on a traveling belt made of fine mesh screen. Water delivers the pulp to the screen and, as the screen oscillates from side to side and travels forward, much of the 98% to 99% water content is removed by drainage and suction.

The wet web of paper passes from the wire screen to a traveling felt web which carries it over and under many heated rollers and dries it.

During and after this operation, there are numerous things that can be done to the paper to secure certain effects of finish or to prepare the paper for a given use. One example is a treatment which consists of running the dry web of paper through a vat containing glue-size so the surface will provide a clean, sharp outline of the type impression and make erasing easier. While this is only one of a great many different treatments that may be given to paper, it is also true that not all papers are given this treatment.

Manufacturers tell us that their paper making is essentially an art and that it has not as yet reached the status of an exact science. This would lead us to expect a great deal more variation, especially between brands of paper, than is at present experienced. It is recognized that manufacturers' paper tests cannot be conducted in branch offices but is felt that a knowledge of how paper manufacturers control the various factors in their finishing process will prove helpful as well as interesting in conducting comparison tests anywhere.

Bond papers are made by hundreds of paper makers in all parts of the country and although certain standards have been established as to weight, thickness and color, a number of variables still exist.

Two-sidedness will be more prominent in some papers than in others. This is a condition which is established in the forming of the paper sheet as it travels over a wire screen where the water is shaken and drawn out of the pulp. Tiny fibers are drawn down toward the screen and, in so-called low finish papers, the watermark side will not be as smooth as the wire side. Highly finished papers may pass through huge calender-

ing rolls where the pressure minimizes two-sidedness to a degree which is no longer noticeable. The two sides of the paper are referred to as the wire side, which occasionally may be found to produce better looking typing, and the felt side, which shows the watermark. Printers may prefer the felt, or watermarked side, so that, on printed letterheads and stationary the typewriter operator will have no choice as to which side may be used for typing.

The weight of paper is standardized and subject to tests. An example is 20 pound bond, which is standardized so that a ream of 500 sheets, size 17" x 22" weighs 20 pounds. This size, cut twice, results in four sheets, size 8-1/2" by 11", a ream of which would weigh 5 pounds. Paper weight standards are not always uniform and may be based on 480 sheet reams, 500 sheet reams or 1000 sheet quantities.

Bursting strength is tested, usually by applying pressure against a sample through an opening approximately 1/24" in diameter. The pressure required to burst the sample is recorded and compared to a standard. Manufacturers favor a folding test to the bursting test, however.

The folding endurance of paper is tested in a machine which folds the paper back and forth while a counter registers the number of double folds required before the paper breaks.

Tensile strength is measured in a device equipped with a weighted pendulum to which one end of the paper strip sample is attached while the other end is fixed. As the pendulum swings, an indicator stops on a scale graduation at the point where the paper breaks. This reading is then compared to a standard. Tearing resistance is gaged by the average force required to continue a started tear for a fixed distance.

Smoothness of surface is tested in a device which holds the paper surface against a machined

surface while a vacuum is created in a graduated air chamber. As air flows back into the chamber it must pass between the paper and the smooth surface. The time required for a column of mercury to fall a given distance in the chamber is measured and the figure is compared to a standard. Another type of meter utilizes pressure instead of a vacuum but the results are similarly calibrated. Gloss is measured according to the amount of light reflected from the surface.

The formation of a sheet does much to indicate the quality of the paper. A term used to describe paper of poor formation is "wild", wherein fibers appear in dark clots interspersed with light streaks and patches. In a "well-closed" sheet the fibers are more evenly distributed and light can pass evenly through the paper.

Opacity of different papers can be tested and compared by placing different samples over a black line to decide which is more opaque. A photometric test may also be used to compare paper with a given standard.

Dirt and foreign particles in the formation of the paper contribute to poor quality by interfering with the ability of the paper to accept a good coating and in the general appearance of the finished paper.

Permeability is the degree to which a sheet of paper permits the passage of vapor. Standards are maintained by which paper makers can compare samples of their product.

A heat test acts as an accelerated aging test. Although heating is not encountered in the normal aging of the paper, the effects on the structure of the paper under test are such that comparisons can be made and relative ages of paper can be determined.

The fact that a brand of paper has a rag content

is not alone indicative of superior quality. Rag content in paper can make paper more durable, more fold resistant and more tear resistant and many brands of bond paper carry a rag content to give them durability. Many sulphite bonds, pulp papers with no rag content, show tough characteristics that help them resist the cutting and embossing of type as much as in some rag content papers. The amount of rag content, the condition, whether new or used rags: the treatment of the rags, whether undyed or dyed and bleached, will vary greatly in the production of papers, so rag content alone is not indicative of toughness. Comparative testing must be done before a decision is made as to the suitability of any paper.

The tests described do not provide complete coverage of all of the characteristics of paper but do furnish an opportunity for grading papers on a comparison basis.

It is recognized that the Customer Engineer cannot test papers by these methods in the field. Certain aspects of paper structure can, however, be determined in the field from stocks available. Tests and comparisons should be conducted continuously to find out what papers are toughest, which accept ink most readily, which papers best lend themselves to erasure and which can best be used in multiple copy work.

The toughness of a paper can easily be decided, on a comparison basis, by setting up a form of one original and two copies, using the sample to be tested as the original. Type on the form with the impression set first low and then high. Compare the paper with other samples, treated in the same manner, as far as resistance to cutting, acceptance of ink, color of impression, sharpness of impression and ease of erasure.

Papers best suited for use as originals in the typewriter are those which readily accept ink, either from fabric ribbon or from carbon paper

ribbon, papers which are tough and resist the cutting action of the type and papers which have a good color so as to provide proper contrast with the ribbon ink. The surface must be sufficiently treated and bonded to resist the abrasive action of the erasure.

It will not often be necessary to have a customer change to another paper to clear up a case of embossing. Adjustments may be made including adjustment of ring and cylinder, power roll speed and impression control. The platen should be changed if it is considered too hard and type faces should be treated if certain of them appear to emboss excessively.

Humidity has an effect on paper during its use in typing, especially with carbon papers and carbon paper ribbons. The higher the humidity, the less the ribbon inks can adhere to the paper because moisture absorbed by the paper naturally resists wax and oil and the expansion of the paper fibers reduces the capacity of the pores to take or hold ink. Small changes in humidity are not noticeable, but extreme changes may show some comparative differences.

These, then, are the items to be considered when anyone is striving to secure the greatest number of legible carbon copies and maintain satisfaction in all phases of the work. Any question as to how many carbon copies can be made on a machine must depend upon how these items are combined in the application.

### CARBON PAPER RIBBONS

The manufacturing date code is stamped on each ribbon hub. This number indicates, in its first two or three digits, the month and year the paper was processed into its final form. Aging improves the quality of work done with carbon paper ribbons. IBM carbon paper ribbons are aged prior to final processing in order to provide more uniform results.

## #510 Ribbon

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.  
 Now Is The Time For All Good Men To Come To The Aid Of Their Party.  
 now is the time for all good men to come to the aid of their party.

## #520 Ribbon

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.  
 Now Is The Time For All Good Men To Come To The Aid Of Their Party.  
 now is the time for all good men to come to the aid of their party.

## #530 Ribbon

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.  
 Now Is The Time For All Good Men To Come To The Aid Of Their Party.  
 now is the time for all good men to come to the aid of their party.

## #540 Ribbon

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.  
 Now Is The Time For All Good Men To Come To The Aid Of Their Party.  
 now is the time for all good men to come to the aid of their party.

## #550 Ribbon

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.  
 Now Is The Time For All Good Men To Come To The Aid Of Their Party.  
 now is the time for all good men to come to the aid of their party.

## #560 Ribbon

NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.  
 Now Is The Time For All Good Men To Come To The Aid Of Their Party.  
 now is the time for all good men to come to the aid of their party.

Figure 209. Carbon Paper Ribbons

The identification code is printed on the hub and indicates, with its first digit, the width of the ribbon. The width indicates the ET model for which the ribbon was designed.

- |   |       |  |
|---|-------|--|
| 1 | 9/16" | Model 01 Standard IBM Electric Typewriter with Carbon Ribbon Attachment  |
| 3 | 9/32" | Model 04 IBM Electric Executive Typewriter   |
| 5 | 5/16" | Model 1 Standard IBM Electric Typewriter with Carbon Ribbon Attachment Models 4 and 5 IBM Electric Executive Typewriters |

The second and third digits indicate the writing intensity (Figure 209).

- |    |                                      |
|----|--------------------------------------|
| 10 | Extra Sharp, on 7 pound paper        |
| 20 | Extra Sharp, on 9 pound paper        |
| 30 | Sharp, gray black colored impression |
| 40 | Medium                               |
| 50 | Medium Intense                       |
| 60 | Intense                              |

Thus, a 140 ribbon indicates a 9/16" carbon paper ribbon with medium impression for the Model 01 Standard machine with a carbon ribbon attachment. 540 indicates a 5/16" ribbon, with a medium coating, for the Models 4 and 5

Electric Executive typewriters or, for the Model 1 with a carbon ribbon attachment. In every case, the tissue weight and the carbon coating are identical for all ribbons in any given group, that is, ribbons numbered 120, 320 and 520 are alike except for width, the type of core plug used and the length of the ribbon.

#### 110, 310 and 510

These ribbons are coated to give a sharp, gray-black impression. In the 510 style, for the Model 4 and 5 machine, these ribbons contain approximately 800 feet of high quality carbon on a 7-pound backing, and should be recommended for all work requiring sharp definition, whether correspondence, photographic masters or direct-to-plate work on metal or coated paper plates, except parchment. These ribbons should be recommended for "fill-in" work. They can be used for small type faces and Executive types except PO type.

#### 120, 320 and 520

The amount and type of coating is the same on these ribbons as on the '10 series described just previously, but are made on 9-pound paper. Character impressions may be expected to be slightly broader and darker than with the '10 series ribbons. This ribbon should be regarded as a general purpose ribbon on all Executive and small Standard type faces.

#### 130, 330 and 530

These ribbons are made on the same 9-pound paper as the '20 series, but the carbon used produces a sharp, slightly gray colored impression. They may be used for all Executive and Standard type faces on applications the same as the '20 series.

#### 140, 340 and 540

The coating on these ribbons is soft and produces

clean, sharp, slightly intense impressions, which are broader than the '20 series ribbons. The backing is 9-pound paper. They may be recommended for correspondence where a darker, slightly broader write is desired and for photographic reproductions with all Executive and Standard type faces. The '40 series ribbons are exceptionally well suited for making Ozalid masters, especially when an intense carbon sheet is used to back up the master and a plastic spray is used after typing to "fix" the surface to prevent smearing.

#### 150, 350 and 550

Impressions from these ribbons are more intense than those from the '40 series, although they can be recommended for the same applications and for all Executive and Standard type faces. These ribbons are made on a 9-pound backing paper.

#### 160, 360 and 560

These ribbons are soft coated to produce intense impressions. Recommend them for all applications, except for typing parchment paper mats, with all except small type faces. The backing is 10-pound paper.

#### 170

These are the softest coated ribbons available and produce very intense characters of strong color. They may be used on similar applications to the '60 series. The backing is 12-pound weight.

Choice of ribbons may vary slightly with individual preference but the '20 series ribbons have been universally accepted as general purpose carbon ribbons.

#### 5550-1 and 5550-2 Acetate Carbon Ribbons

These ribbons are backed with acetate film,

instead of paper, and run approximately 800' in length. This construction permits them to release all of their carbon coating when struck by the type face. The suffix 1 on the number indicates a coating of one-point carbon intensity which is recommended for use with 1/45 pitch and small or thin line type faces. The suffix 2 means a two-point coating, suitable for the heavier or bolder types. PS, or fine line type can be used with either ribbon. Smooth, coated papers will not show up the difference between one-point and two-point coating that can be seen on other papers. Papers without a smooth, enameled finish show a great difference in the sharpness of impression between the two coatings. The primary use for acetate ribbons is in making photographic masters and the best results are obtained by typing on a coated or enameled paper.

Results obtained from some brands of paper plates have been improved by using acetate ribbons and by backing up the paper plate with a film sheet of about .005" thickness, using a soft, number 1 platen. The film sheet will cause no improvement when used with a harder platen. Generally a harder platen is used when typing paper plates with a carbon paper ribbon, however. Some brands of paper plates are not suited for use with the acetate ribbons while others are well adapted. Plates which are not suited will readily show a very spotty and irregular reproduction, while plates which are suited will show such a marked improvement and such a regular, even impression as to leave no doubt. It should be determined locally which plates respond to the acetate ribbons in order to make recommendations for their use.

The greatest advantage of these ribbons is the total carbon release. Ribbon feed must be capable of full feed because any overlap will appear as a broken letter. There will be no carbon left on the backing to cover an overlapping impression.

Acetate ribbons are not provided in the 9/32" width for the former Model 04 Executive typewriters because of the absence of a take-up spool and the presence of static electricity in the acetate which causes the used ribbon to cling to the typewriter and desk.

The complete carbon release makes the acetate ribbons somewhat heavy for correspondence. The typing will be black and full but the possibility of smudging and the difficulty of erasing on any but coated papers make acetate ribbons a secondary recommendation for correspondence. Anything, except plates, typed with acetate ribbons can be sprayed with a lacquer spray which will "fix" the impression and prevent smudging. If the work is to be photographed, the spray should be used sparingly to avoid a glossy finish. Gloss in the hollow impressions of embossed letters will create reflections which will photograph as broken places in letters.

#### Heavy Backed Carbon Paper Ribbons

These ribbons have a heavy gray paper backing which renders them more cut resistant and, due to their increased thickness or caliper, they produce a broader write than the thin carbon paper ribbons. It is advisable to stock these heavy ribbons so that all are 6 months old or older, to avoid contrast between new and old ribbons. This precaution does not apply to other carbon paper ribbons.

These ribbons are made on two weights of paper, 11-pound, with a medium and a soft coating, and a 15-pound, with a soft coating, only. The coding for the heavy backed ribbons is arranged as follows:

- 341, 541 - Medium coating on 11-pound paper
- 551 - Soft coating on 11-pound paper
- 561 - Soft coating on 15-pound paper

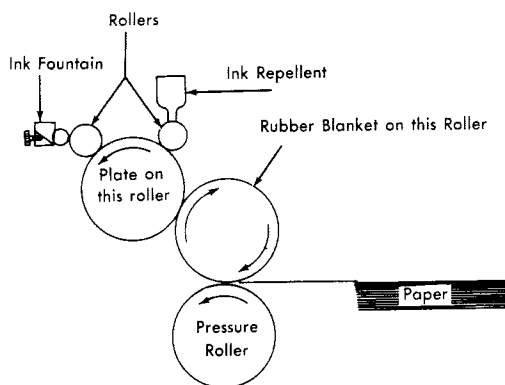


Figure 210. Offset Reproduction

Recommendations for use will parallel the respective codings of the '40, '50 and '60 series of ribbons, previously described.

### PAPER PLATES

One process of offset printing employs a paper plate, prepared with a semi-glossy surface upon which material may be typed with a cloth ribbon or, if the surface of the plate is suitable, with a carbon paper ribbon to provide a sharper detail in the copy.

The paper plate is removed from the typewriter and treated with an ink repellent solution which renders all parts of the surface, except the actual impressed image, impervious to ink. The plate is then placed on the drum of the duplicating machine (Figure 210) and, as the drum rotates, a roller applies a small amount of dilute repellent solution to the surface, followed by an ink application from other rollers. The ink thus deposited on the impressed image of the plate is transferred, in reverse image, to the surface of a rubber covered drum. As paper is fed through the machine, the image is picked up from the rubber drum and the process is repeated as often as required up to the limit of the plate life. Plate life is variable depending upon several factors. For example, heavy pressure on the duplicating drum will limit the

plate life, each re-run limits plate life, and too heavy an impression during typing will break up the water barrier which has been built into the surface of the plate and reduce the number of copies obtainable.

Paper plates should not ordinarily be run on the duplicator immediately after typing. During typing, the structure of the plate is compressed under each type impression. Given sufficient time, about an hour, the fibers regain some of their shape so as to bring the impression up closer to the surface where it will transmit ink more easily to the printing drum. This recovery process has been hastened in some instances by application of moisture to the back of the plate, but difficulty was experienced in handling the plate and securing it to the drum. Another means that has resulted in hastening plate recovery is to subject the plate to the rays of a sun lamp or heat lamp.

In the event that the type face cuts the type outline out of the carbon ribbon and impresses it on the plate, the impression may be reduced slightly or the type face treated to prevent cutting.

The platen used is important in that a soft platen may cause a loss of detail in the outline of the characters, while a platen that is too hard may contribute to cutting.

The following information will serve as a guide in selecting the proper platen:

	Carbon Ribbon	Cloth Ribbon
Elite, Pica, Secretarial and similar types	No. 1	No. 2
Modern, Documentary and similar types	No. 2	No. 8
Bold Face Types	No. 8	No. 8

Ring and cylinder should be adjusted so as to "shift off cylinder" by approximately .006" in the upper case, if all upper case characters appear too black or blurred. If individual type bars are too light in the upper case, use the S-6 bar bender to make them heavier on cylinder. If any individual type is too dark in the upper case, bar bend it off cylinder until an even impression exists on all type.

Uneven impression, showing the same character sometimes light and sometimes dark, may frequently be traced to finger prints on the plate. Moisture from the hands, deposited on the face of the plate, will prevent the surface from taking a good deposit of carbon, or ink, from the ribbon. It is also helpful to lightly wipe the surface of some paper plates with a piece of clean, dry cotton before typing, to remove any oxidization due to age, which would prevent the carbon, or ink from adhering to the plate.

In preparation of paper plates it will be noted many times that, in spite of observing every precaution, the plate may appear uneven in impression. This observation might lead to a conclusion to use a softer ribbon or otherwise attempt to secure a more dense impression. To do this would be a mistake, because no paper plate should be judged solely by its typed appearance, but rather by its finished reproduction. If the finished reproduction shows a great number of hollow characters and letters, it is usually an indication that the ink is not feeding fast enough or that too much repellent is being used (Figure 210). Hollow punctuations may be corrected by placing the plate, face down, on a clean flat surface and rubbing over the backs of punctuation marks with a round smooth object such as the metal tip on some copying pencils.

Erasing errors from the plate should be done with a soft, clean, grit-free eraser in such a manner that the surface remains intact. If the

surface becomes rough or scuffed, the water barrier may be broken so the area is apt to pick up ink and become a smear on the copies. With careful application of extra repellent solution the duplicating machine operator can eliminate or minimize these blemishes, but careful erasing in the first place will not make such a treatment necessary. Retyping over erasures should be double typed.

It is advisable to refer to the manufacturer's recommendations concerning procedure for handling and the number of copies to be expected from a given plate.

A 520 carbon ribbon is recommended for general use in typing plates. If a broader effect is desired, the 540 ribbon should be used. For a sharper definition, the 510 is recommended.

In the use of cloth ribbons, where definition of line is secondary to securing a larger number of copies, the Executive, 40, cloth ribbon is recommended, or the Superior Write Nylon ribbon, 40. For recommendations regarding Acetate ribbons, refer to Carbon Paper Ribbons.

#### METAL PLATES

Plates of aluminum or zinc alloys are used to secure large numbers of copies. In using such plates, a certain amount of embossing is desirable as long as the surface is not punctured at any point. A 1 platen is recommended along with a slightly heavier impression setting than that used on paper plates. With the impression set too heavy, some type faces will cut through the ribbon, if carbon ribbon is used, and will leave a portion of the ribbon deposited on the plate. This will result in a hollow or outlined character unless discovered and removed before the plate is inked. In that case, the impression should be reduced, either by cutting down on the impression of all type, or by adjusting the indi-

vidual impression control screws. If reducing the impression tends to leave a light and dark effect which may influence the finished work, then leave the impression adjustment heavy enough to guarantee uniformity and treat the face of the type to prevent cutting.

A metal plate, as well as a paper plate, should be judged according to the finished copy rather than by the appearance of the plate. The process for duplicating both plates is very similar. It is obvious then, that if the full form of a character is impressed on the plate, and if the carbon deposit completely fills that outline, then the reproduction from that character will be complete and will not accept the repellent solution used in the duplicating process.

The 520 carbon paper ribbon is generally recommended for all work. If a finer, sharper result is desired, 510 should be used. For a broader result, 540 is recommended.

The plate must be fed carefully through the typewriter to avoid scratching the surface. Scratches will pick up ink impressions just as quickly as will typed impressions. It has even been noted that the backs of finger nails coated with nail polish, will leave invisible streaks on the surface of the plate, which, when duplicated, will pick up ink and streak the copies. Finger prints, although they may not be seen, render a plate incapable of accepting typed impression.

The plate should then be placed, face down, on a very smooth surface, preferably a sheet of plate glass. A porcelain wallpaper seam roller should be used to roll out as much as possible of the embossing. After the rolling operation, the plate will still be embossed to some degree, but experience has proven that this embossing is not only desirable but very important in order to properly retain ink and carbon for successful long runs.

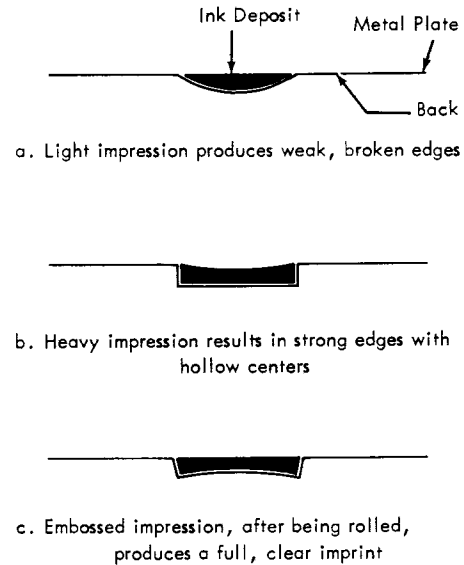


Figure 211. Proper Impression for Metal Plates

When the metal plate has been typed, it should be treated by coating its surface with the proper repellent solution.

The cross-section illustrations (Figure 211) show why this embossing and rolling process can produce a better result.

### PHOTO OFFSET PAPERS

The photo offset application requires that typing be photographed and that a plate, similar to a metal typed plate, be made from the photo. The plate can then be used in the same manner as the paper plate or the metal plate but a longer run can be made.

A paper suitable for this application must have a very smooth surface so all parts of a type face will register in detail with no broken lines. A high gloss is not required and may prove undesirable if the type face has a tendency to pierce the enameled surface and leave a halo effect in the impression. An enameled paper with a dull finish has proven most satisfactory. This type of paper is adapted to erasure by using art gum first to remove the heaviest of the carbon followed by a grit-free rubber eraser.

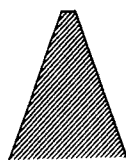
## STENCILS

The typed stencil is very widely used as a means of duplicating information. There are many different kinds of stencils in use and no attempt will be made here to classify them. A stencil is made by coating a sheet of fine, long-fiber tissue with a wax and oil preparation. This stencil sheet is then attached to a parchment-like backing sheet designed to provide a firm support to the stencil as the type strikes.

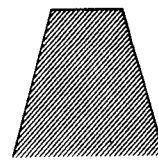
Cushion sheets are used between the stencil and the backing sheet. Their function is to accept the unwanted wax and oil which will be driven through the stencil as the type strikes. Cushion sheets may be of a blotter type which can cause the wax and oil to adhere to their fibers or they may be of the wax type and permit the type blow to fuse the unwanted wax and oil from the stencil into their own composition. Removal of the cushion sheet, after the stencil is typed, removes the unwanted wax and oil from the type impressions, leaving the characters open to permit the stencil ink to pass freely through to the copy paper.

In order to obtain a sharp impression, the cushion sheet may be removed and a firm heavy material may be used in place of it to back up the stencil. Some stencils are provided with a plastic sheet which serves this purpose. A slightly broader impression may be obtained by placing a cushion sheet between the stencil and the plastic sheet. A still broader impression will result by removing the plastic sheet and using only the cushion sheet.

Some stencils are provided with a film-like cover sheet or are used with a film-like ribbon which is designed to prevent cutting and keep type faces clean. While these devices do achieve these advantages, they result in a somewhat broader type impression which will not be quite



Cross Section of Standard Type



Cross Section of PE or PM Type

Figure 212. Cross Sections

as sharp in outline. Whenever certain type faces cut out the stencil, leaving a hole through it, the surface of the individual type face may be treated so as to reduce the cutting edge. If the cutting condition is general over all the type and especially if the machine has been making good stencils without cutting out, but suddenly starts to cut, then it is possible that the platen or the stencil is chilled and causes the wax to become brittle. When the wax is brittle it is very easy to cut out letters. Warming the platen or the stencil, or both, will clear the trouble.

In order to make a stencil with the bolder faces of type, such as PE and PM, it would be well to understand the mechanics of stencil typing (Figure 212).

The narrow surface of standard type can easily push the comparatively small amount of wax through the stencil and into the cushion sheet. The broad face of the bolder type will impact the wax into a fairly solid mass and the result will be a letter with a mottled or hollow appearance. A stencil prepared with less wax and more oil will produce a better result under these conditions. Some of these stencils are yellow in color.

Stencils may be made with PE and PM types with ordinary stencils, also, by turning the parchment-like backing sheet up out of the way while typing on the stencil backed up only with a cushion sheet. In this way the cushion sheet rests directly on the platen. Very satisfactory results

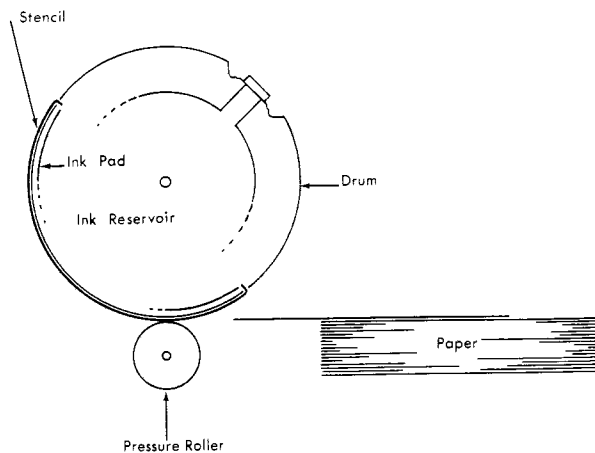


Figure 213. Mimeographing Process

have been achieved with an 8 or a 2 platen, where usually a 9 or a 1 platen is required for stencils. Care must be used to prevent stencils from wrinkling when working without the backing sheet.

In order to find the best impression setting for stencil work, it is recommended that the operator start at zero setting and gradually increase until the proper setting is reached. When a stencil is typed, it should be held up to the light to see if all characters are open and will permit ink to flow through them.

The mimeograph machine is not a complicated device (Figure 213).

The paper being processed through the machine must have the ability to quickly absorb the ink which is being fed through the ink pad. The ink pad must be fresh and free from dried ink in order to operate properly. The pressure roller must exert sufficient pressure evenly over the entire surface of the paper so that all parts of the paper are properly pressed against the stencil. Uneven impression, where one side or one part of a page is lighter than another will result from a defective pressure roller.

Mimeograph ink is an important consideration in the reproduction of good stencils. Due to the large number of inks available in both the water base and oil base types, no attempt will be made to discuss the various kinds of result to be expected from them. It should be borne in mind that ink can influence the performance of the mimeograph and, before altering anything in a system which had been functioning properly, it would be well to inquire whether the ink has been recently changed.

In some installations, an operator will attempt to run mimeograph copies with very little ink so as not to "offset" on the backs of the sheets. As soon as this is done, the contour of the letter may break up so that the copy looks thin and weak. This is particularly true when working on bond paper with its smooth surface. The operator should then be encouraged to use mimeograph paper in order to pick up ink faster or the bond paper will have to be "slip-sheeted", a process sometimes done by hand, but more often done by the machine, in which extra thick sheets of absorbent card are interleaved with the pages of copy. So-called fast drying inks will require no slipsheeting on mimeograph paper but they will not dry as quickly on bond papers.

In summary, then, the following steps should prove advantageous in working out of trouble on a stencil application.

Examine the typed stencil and correct any irregularities in type alignment or impression.

Learn the operator's requirements concerning sharpness of print.

Recommend the proper combination of cushion sheets, backing sheets, cover sheets and platen to give the sharpness required.

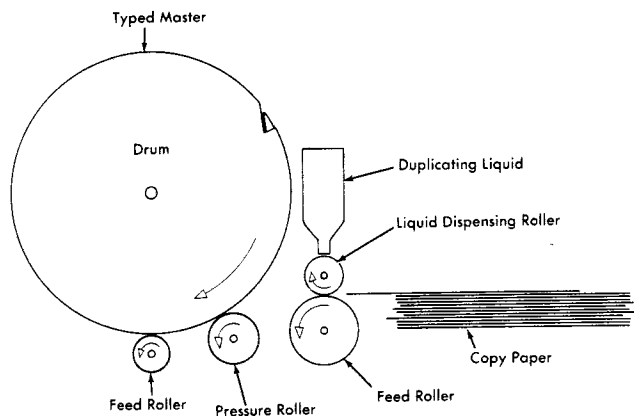


Figure 214. Spirit Duplicating Process

Determine by examination of the copy whether the mimeograph machine is in good working order. Such faults as inking heavily or lightly in certain parts of the copy would not ordinarily be caused by a defect in the typewriter with the possible exception of one complete side being heavy or light due to uneven ring and cylinder.

Lastly, and most frequently, the customer may require a stronger print but will not want to apply sufficient ink because it would offset on the backs of the copies unless they used slip-sheets.

Coordination between Customer Engineers and service personnel of the duplicating machine companies has always brought about satisfactory results and should be developed.

### SPIRIT DUPLICATING

The process of spirit duplicating is usually accomplished by typing on a smooth finished master with a heavily coated carbon paper with a special finish held against the back of the master. Type impressions will appear in reverse on the back of the master sheet. The master is then placed on a drum (Figure 214) and copy paper is fed through the machine. An instant before the copy

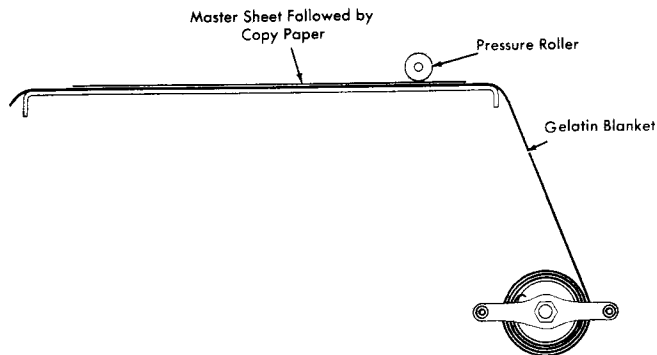


Figure 215. Gelatin Process

paper is pressed against the master, it is coated with duplicating fluid which attacks the carbon impression on the master and causes a small amount of the deposit to transfer to the copy paper. Pressure and the flow of fluid are controllable.

The detail obtained in the reproductions will depend on the platen. A soft platen will produce a broad outline lacking in detail. A firm platen should be used with a fairly light impression setting.

### GELATIN PROCESS DUPLICATING

This process requires a positive master typed with a Hektograph ribbon on its surface. The master is pressed or rolled against the gelatin surface of the blanket on the flat bed duplicator and removed, leaving a reverse impression of the master. Copy paper, pressed or rolled over the gelatin, picks up the impression and duplicates the master (Figure 215). Impressions eventually fade from the gelatin which may then be used for further impressions.

The master may be backed up with a sheet of tough tissue to prevent excessive embossing which would result in heavy edges and light centers in the letters.

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